The Bulletin

of the

American Association of Nurse Anesthetists

MAY
1942

VOLUME 10 NUMBER 2

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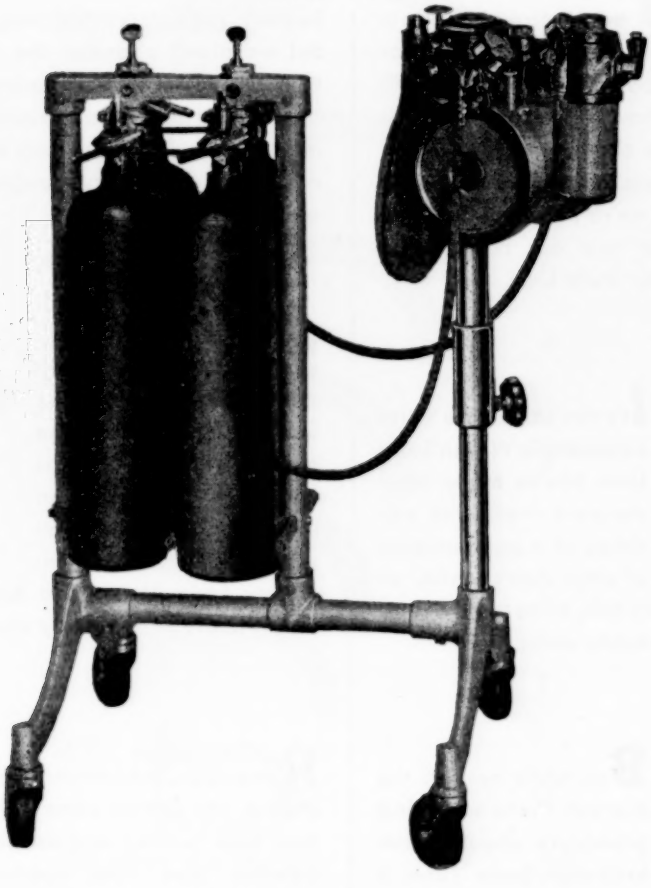

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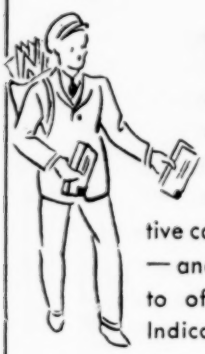

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PENTOTHAL ANALGESIA IN UROLOGY

REED M. NESBIT, M.D.
Ann Arbor, Michigan

Read at the eighth annual meeting of the Mid-South Post Graduate Nurse Anesthetists Assembly, held in Memphis, Tennessee, February 11-12, 1942.

There are two means of avoiding or minimizing the discomfort which accompanies urological instrumentation. These are the use of some form of anesthesia and the employment of manual gentleness by the physician. Gentleness in manipulation is one of the medical arts with which some men are born but which all must cultivate who would be successful in the practice of urology. The utmost gentleness, however, usually fails to prevent the patient from having an unpleasant memory association of discomfort from instrumentation. Common knowledge among the laity as well as the profession indites cystoscopy as a painful procedure.

The ideal anesthetic for urological instrumentation should fulfil several requirements. It should relieve apprehension which causes the patient to exaggerate all painful stimuli. This fear of being hurt puts the patient into a state of muscular tension and increases the trauma of instrumentation. The ideal anesthetic agent will completely allay the apprehension which exists and will, in so doing, remove a potent source of discomfort. The ideal anesthetic should also prevent painful stimuli from reaching the higher centers and should blot out the memory of pain. It should be a short-acting agent to facilitate full post-cystoscopic cooperation of the patient and should not produce nausea or other unpleasant sequelae which might be as objectionable as the averted pain. Further, the ideal anesthetic agent should have a wide margin of safety, and be inexpensive and easily administered.

Local anesthetic agents have failed to live up to these several requirements in that they do not allay apprehension and do not completely abolish pain or the memory of pain. The various volatile anesthetic agents have been unsatisfactory in that they fail to provide uniformly good relaxation. The patient is frequently uncooperative or nauseated for long periods following examination. Regional block anesthesia has been utilized but has the objectionable feature of needle puncture and does not allay apprehension. However, regional block anesthesia continues to be most satisfactory in some situations demanding the maximum degree of relaxation.

A new field for clinical investigation has been opened by the advent of intravenous anesthetic agents. Evipal was tried but was early abandoned because of its relatively narrow margin of safety. Sodium pentothal has been used for three years. This agent fulfills most of the requirements that have been enumerated. One objectionable feature is the prolonged period of post-cystoscopic somnolence which frequently occurs. Situations which require patient cooperation, such as holding the breath for exposure of x-ray films, are occasionally delayed for a considerable period, thus tending to upset the time schedule of the cystoscopic room. When pentothal has been used to produce complete surgical anesthesia, it has occasionally produced respiratory de-

pression. The hazards of overdosage of pentothal have been demonstrated comprehensively by Moyer and others.

In an effort to utilize the distinct advantages of sodium pentothal and to eliminate the disadvantages of that agent, a technique of administration has been devised for urological instrumentation which has proved so satisfactory as to approach the requirements which have been set up for the ideal anesthetic agent. It has long been recognized that the inhalant anesthetic agents produce a period of excitation which is known as the first stage of anesthesia. The opposite is true of the barbituates in that the early effect of the agent is truly one of analgesia in which apprehension disappears and in which relaxation, both voluntary and involuntary occurs, the perception of painful stimuli is dulled considerably and finally the memory of pain abolished. Thus, properly induced and conducted pentothal analgesia affords an ideal psychological and physical state for the conduct of the usual urological examinations. The patients given the small doses required for analgesia rarely lose consciousness and are always able to cooperate immediately after examination in holding the breath, moving about from table to stretcher, et cetera. They are never nauseated and never apprehensive.

The actual technique of administration is as follows: Preoperative medication consisting of a hypodermic of morphine 1/6 grain is given to the patient on call. The patient is prepared for cystoscopy in the usual fashion and a small bore needle introduced into the arm vein. A 2.5 per cent solution of sodium pentothal is then administered slowly, the anesthetist talking constantly to the patient and informing the patient that in a few moments a state of sleepiness will be induced. The patient is asked to inform the anesthetist when this occurs. Usually the patient states that he is sleepy after from 6 to 10 cc. of the anesthetic agent have been administered. When the patient says he is very sleepy, the examining physician says to the patient, "I am now going to pass an instrument which you will feel. It will not hurt you. You are to remain quiet and relaxed while I am carrying out this examination." So saying, the examining physician passes the instrument and conducts the examination. The anesthetist continues to give a small amount of the anesthetic agent as required during the examination in order to keep the patient entirely cooperative. At the end of the examination, when the instruments have been removed, administration of the anesthetic agent is stopped and within a few seconds the patient is conscious and entirely willing and able to carry out any command which is given. In fact, the majority of patients at this time express surprise that the examination has already been completed, having no memory of the event.

The use of pentothal analgesia has been so satisfactory in our hands that we now use it almost as a routine procedure in diagnostic cystoscopy and in all instrumentations and dressings in which discomfort is anticipated.

The complete post-manipulative cooperation of the patient eliminates all delays previously experienced when either general or local anesthetic agents were used. We have thus been able to carry out a greater number of examinations and manipulations in a given period of time than has been possible heretofore. The patients who are familiar with other types of anesthesia invariably

profess a decided preference for pentothal analgesia once they have experienced its use.

In the past four months the administration of sodium pentothal for analgesia has been attempted 283 times for cystoscopic examination, urethral instrumentation and dressings. In only twenty-two instances (7.8 per cent) was the analgesic effect unsatisfactory for examination. In each of these cases an additional amount of the drug was therefore administered until surgical anesthesia was obtained and the examination carried out. An analysis of these twenty-two failures demonstrates that they were, in most instances, a result of three causes; first, failure to give premedication; second, excessively long examination requiring from thirty to forty-five minutes in the hands of an inexperienced cystoscopist of the intern or resident rank; third, unusual irritability of the bladder, such as in tuberculosis and malignancy. In spite of these analgesia failures there were no instances in which the examination was in any way delayed or interfered with and in none of the cases where surgical anesthesia was necessary did excessive amounts of the agents have to be given.

A review of the entire 283 cases was made in order to determine the amount of sodium pentothal used in each instance. I have previously stated that a 2½ per cent solution was employed. The average amount used for the 261 cases in which satisfactory analgesia occurred was 11 cc. The maximum amount used in this group was 42 cc. and the minimum amount 2 and 1/2 cc. In the twenty-two cases where analgesia failed and further administration of the agent sufficient to produce anesthesia was necessary, the average amount administered was 32 cc., the maximum 60 cc. and the minimum 12 cc. In the entire group of 283 cases there was no respiratory depression observed or any other complication which could be blamed upon the intravenous agent.

It appears to me from these observations that sodium pentothal can be administered safely to produce a state of analgesia to facilitate urological instrumentation. The use of this agent as described is not time-consuming; does not interfere with cooperation of the patient after manipulation; abolishes memory of discomfort; and does not produce nausea or vomiting. For this reason fluids can be forced until slightly before examination time.

ANESTHESIA IN THORACIC SURGERY

HOWARD T. BARKLEY, M.D.
1215 Walker Ave., Houston, Texas

Introduction

The rapid advancement in the field of thoracic surgery during the past ten years has been due, largely, to the concomitant rapid advance of knowledge in the field of anesthesiology. It has been only during the past fifteen years that surgical collapse therapy for treatment of pulmonary tuberculosis has come into widespread use. Even more recently the intrathoracic operations for removal of mediastinal tumors, partial or total pulmonary resection for malignant and non-malignant diseases of the lungs, cardiac surgery, and various other procedures have been rendered feasible and safe by the increased knowledge of physiology of the chest and the refinement of anesthesia techniques.

It is amazing that this important branch of surgery was retarded for many decades because of the lack of knowledge regarding the mechanics of the chest. In the early days of pioneering in chest surgery, many elaborate and costly devices were constructed to maintain a negative pressure outside the thorax to prevent collapse of the lung when the chest wall was opened. These were never successful, and were rendered obsolete and useless by the simple expedient of applying positive pressure within the trachea and lungs when necessary, so that the lungs may be expanded or deflated at will. Thus was developed intratracheal intubation.

All that was required then was the development of a good, safe anesthetic agent which would fulfill most of the requirements of the perfect anesthetic. With the development of cyclopropane we have approached the ideal in this regard.

Read at the annual meeting of the Texas Association of Nurse Anesthetists, held in Houston, Texas, February 27-28, 1941.

Choice of Anesthetic Agent

It is not our purpose to enter into any controversial discussion as to the relative merits of the various agents used in clinics throughout the country. Suffice it to say that in our opinion every conceivable operative procedure pertaining to the thorax can be accomplished by the use of novocaine, or cyclopropane-oxygen, or a combination of the two agents.

Wiggin and Schultz have very aptly stated the requirements for the ideal anesthetic: "It should be: nontoxic to vital tissues, non-irritating to the respiratory tract, rapid acting for induction to eliminate stimulation of secretory reflexes and excitement, controllable for maintenance of anesthesia, with low concentration to ensure complete oxygenation, quiet respirations and prevent anoxemia. It should be a rapidly reversible anesthetic that will allow the patient to return to cough reflex and swallowing as soon as the operation is finished." Under ordinary circumstances cyclopropane meets most of these requirements exceptionally well. With proper induction the patient will go to sleep usually after a few breaths without any troublesome struggling or excitement. However, the smoothness of induction and the maintenance of proper anesthetic levels vary inversely with the amount of disease present in the lungs. Oxygen saturation of the blood can be main-

tained at levels of 95 to 100 per cent because of the low concentration of cyclopropane necessary to maintain anesthesia. The patient returns to consciousness very quickly after the operation and usually it is possible to get him to cough before leaving the operating table or immediately after being placed in bed, which is the best insurance against retained secretions and the occurrence of atelectasis postoperatively. Cyclopropane has its disadvantages and complications, but these are controllable in the hands of the expert anesthetist, and its advantages far outweigh the disadvantages.

Novocaine in a 1 per cent solution is used as a local, or regional block anesthesia or as an adjunct to cyclopropane. The use of local anesthesia is indicated in many procedures in which it is desirable for the patient to retain all reflexes, especially the cough reflex.

Methods of Administration

The peculiar conditions met with in chest surgery have been the stimulus for the development of the intratracheal intubation method of administering the anesthetic. This method has numerous advantages, and one would be foolhardy to attempt many procedures without the benefit of its aid.

Intratracheal intubation provides a safe, adequate airway under all circumstances, through which positive pressure and artificial respiration may be applied and excess secretions may be aspirated; and it insures positive control of the situation at all times. The use of this method is imperative in intrapleural or transpleural operations.

Various techniques for intubation have been devised. The tube should be placed through the larynx into the trachea under direct vision with the laryngoscope. A silk woven Magill catheter with a balloon cuff about one inch from the end is the one of choice, but various types of rubber tubes, spiral wire tubes covered by rubber and others are quite satisfactory. If intubation is done blindly, considerable trauma to the larynx and trachea may result. After the tube is in place, the balloon cuff is inflated, making an air-tight system from the machine to the lungs. It is difficult to know how much air should be put in the balloon so that it fits snugly into the tracheal lumen, but does not cause undue pressure. The intubation may be accomplished following anesthesia by topical application of 2 per cent pontocaine to the pharynx, larynx and trachea, or it may be inserted after anesthesia has been induced with cyclopropane.

Intratracheal intubation has its complications also. Laryngitis with some hoarseness, and varying degrees of tracheitis are not uncommon. The conditions usually are not serious. We have seen, however, a very perplexing and serious complication in three cases. This was the formation of a fibrinous, plastic exudate around the circumference of the tracheal lumen where the balloon had rested. This caused a marked narrowing of the lumen with resultant insufficient airway. It was necessary to bronchoscope each of these three patients and remove the ring of exudate. One patient required bronchoscopy a second time. The ring of fibrin came away without bleeding and no ulceration of the tracheal mucosa was noted. Nevertheless, the advantages of intubation far surpass the disadvantages in the cases in which it is necessary.

The other inhalation anesthetics are given in the usual way. There is no special technique connected with chest surgery.

Preoperative Preparation of Patient and Premedication

The preoperative preparation of the patient with pulmonary disease is important. Each patient has a varying amount of secretions which must be evacuated before the administration of the anesthetic. This usually can be accomplished by postural drainage accompanied by the voluntary effort on the part of the patient to cough and raise all secretions possible before operation. In some instances it is highly desirable to resort to bronchoscopy preoperatively if the secretions are particularly tenacious or excessive in quantity. However, I do not believe that bronchoscopy is always indicated as a routine procedure. It is important to emphasize here that the term "postural drainage" means any position or combination of positions which will increase the effectiveness of the patient's efforts to eliminate pulmonary secretions. If the disease is located in the lower lobes, the usual head-down position is most effectual, but the best posture for adequate drainage is usually known by the patient from his past experience and this should be the one used. It may be accomplished by sitting upright in bed, leaning in one direction or another; lying flat; turning to one side or the other; or a combination of these or other postures. Therefore, if the patient is instructed in regard to the purpose of this procedure, he will not require very much supervision in the task. It is the duty of the anesthetist to see that this has been carried out before starting the anesthetic, and to delay induction until it has been done. This important phase of preparation can be accomplished in the early morning as well as at any other time of day, and I can see no reason for delaying chest operations until the afternoon.

As to premedication, the advice of the anesthetist should be sought. In our experience a small dose of morphine, either with or without a small dose of scopolamine, administered about one hour before induction, has been satisfactory. In case local anesthesia is to be used alone, it is advisable to give one of the barbiturates beforehand. The time is determined by the speed of action of the barbiturate chosen. Although atropine is advocated by many in the belief that it exerts a beneficial influence on inhibition of the secretions and the vago-vagal reflexes, I am convinced that its advantages are more than offset by the tendency to cause inspissation of secretions in the healthy lobes of the lungs with resultant postoperative atelectasis, therefore I do not allow its use in my cases.

In the more shocking operations and lengthy intrathoracic procedures, it is always necessary to have a large bore needle or cannula firmly secured in one of the veins of the leg or arm, for the purpose of intravenous therapy. This should be done before the anesthetic is started, as there is often considerable time lost in inserting the cannula into the vein. Thus a continuous drip of saline, 5 per cent glucose in water, plasma or whole blood, can be administered when necessary to combat shock and fluid loss. This intravenous drip can be continued during the remainder of the day until the patient's fluid balance has been restored to normal levels. This will require varying amounts and types of fluids, which must be determined for the individual patient. Stimulants may be administered by this route also.

The use of adrenal cortical extract or its synthetized equivalent as a preoperative prophylaxis to combat shock is rapidly becoming more popular, and from the reports of various

clinics is efficacious. We have used it to good advantage in a few cases. In cases in which shock does occur, it does not last as long as in comparable untreated cases.

The Position of the Patient on the Table

This is an extremely important factor in all types of thoracic surgery. The patient should be placed in the position which will serve best to increase the speed and efficiency of the surgeon, will meet the anatomical requirements, and yet will be least harmful from a physiological standpoint. It is at once realized that all of these stipulations cannot be met, and are conflicting, and therefore compromises must be made. In many instances the patient is so placed that the good lung is down, so that respiratory excursions of the chest are hampered by the weight of the body and the cramped position, which is not improved by the various supporting braces. The infected secretions readily drain from the uppermost infected lung to the good side. Thus a bad situation is made worse. Therefore it is imperative that everything possible be done to counteract these dangers. The patient should be placed carefully in the most comfortable position possible with the least restriction to the excursions of the chest. To prevent drainage of secretions into the good lung, the patient should be placed in the Trendelenberg position with the head depressed at an angle of 15 to 20 degrees, so that there is dependent drainage to the pharynx. Anything less than 15 degrees Trendelenberg is not sufficient to provide drainage, as has been demonstrated by Haight. Thus the anesthetist is presented with the problem of giving a perfect anesthesia to a patient whose mechanism for gaseous exchange is inefficient because of his disease and is rendered more inefficient by the position necessary.

Selection of the Type of Anesthesia for the Type of Operation

As always in medicine, hard and fast rules cannot be laid down regarding the choice of anesthesia in any given type of case. Each individual case must be considered carefully and the type of anesthesia chosen which will be best suited to meet the requirements of that individual. Many instances will arise in which an operative procedure will be done under local anesthesia, due to mitigating circumstances, which would ordinarily have been done under a general inhalation anesthesia. The reverse will be found to be equally true.

As a general rule local infiltration with 1 per cent novocaine, to which a little adrenalin may be added if desired, is the anesthesia of choice in thoracotomy for drainage of empyemas and lung abscesses. These procedures can be accomplished without the necessity of the patient experiencing any pain. He is awake, able to cooperate, and most important in the case of abscess, the reflexes are not abolished. Therefore, he will be able to cough and raise all secretions which may drain from the involved lobe into the trachea and bronchi, and thus prevent spread of the infection to other portions of the lungs. It is not necessary to maintain positive intratracheal pressure to prevent emptying of an abscess through the bronchi. As the abscess is encountered, a very small opening is made in its wall, just sufficient to admit the suction tip, which is immediately inserted into the cavity and the contents aspirated. If this technique is carried out carefully, preventing an inrush of air into the cavity and the bronchi, the patient will not be disturbed and may not even cough. The

opening can then be made larger to admit packing and proper drainage. The same technique is employed in empyemas. Many of these patients require the administration of oxygen during and after the operation, and postoperatively the patient should be placed in bed in the position which will best facilitate drainage. Local infiltration is also used for internal pneumonolysis and temporary phrenic operations.

The operation for extrapleural pneumothorax may be done very satisfactorily with a combination of local infiltration and paravertebral block. The intercostal nerves are blocked under direct vision after the incision has been deepened through the extra-costal muscles to the level of the ribs. However, it is a matter of choice with the individual surgeon as to whether he prefers a local or general anesthetic. It is not usually considered necessary to employ an intratracheal tube in these cases, as positive pressure is not required and the amount of secretion is not copious.

Cyclopropane-oxygen inhalation anesthesia by the ordinary closed system method, combined with local infiltration of the skin, and block of the intercostal nerves corresponding to the ribs to be removed, is preferable in thoracoplasty, and in extensive operations for chronic empyema. After induction with cyclopropane, the skin is infiltrated with 1 per cent novocaine. Adrenalin should not be used, because it is felt that cardiac arrhythmias are more apt to occur when it is used with cyclopropane. As the ribs are exposed, the intercostal nerves are blocked in the field. The addition of the local infiltration and nerve block has been found to lessen the fall in blood pressure and the shock which may occur at the time of the rib stripping and removal of transverse processes. However, there is always a considerable blood loss in these cases, averaging approximately 500 cc., and there is always some degree of shock. The patient should be awake by the time the dressing is applied and he is ready to be placed in bed. The chest should be supported and the patient made to cough to clear out any retained secretions in the bronchial tree. It is not necessary to give all these patients oxygen therapy postoperatively, but if a routine must be established, it should err on the side of giving too much oxygen rather than deprive an occasional patient, who needs it, of its benefits.

In all operations in which the pleural cavity is widely opened, such as lobectomy, pneumonectomy, removal of mediastinal tumor, resection of the esophagus for carcinoma, and the transpleural approach to diaphragmatic hernia and carcinoma of the cardiac end of the stomach, cyclopropane-oxygen anesthesia should be administered by means of the intratracheal tube fitted with a balloon cuff. The rationale behind this method of administration is fairly obvious. In addition to the advantages previously described, there is always the possibility of opening both pleural cavities, which would certainly result in a fatality if one were not able to keep the lungs inflated and carry on artificial respiration until the chest is closed. These procedures are always of long duration, and shocking to the patient unless the utmost gentleness is practiced in handling the tissues and organs. Although care in handling the thoracic organs increases the operating time, the patient will tolerate this increase in time much better than rough handling and tugging on the lung root and mediastinum. Occasionally it will be of great benefit to the patient, and a distinct aid to the anesthetist, if the

surgeon will discontinue dissection, release all tension, and allow the patient to rest and regain his equilibrium before continuing. The use of local anesthesia plays an important rôle in these cases. It is used to infiltrate the skin along the line of incision and to block the intercostal nerves corresponding to the rib resected and one or two spaces above and below. When the lung root is exposed, the vagus plexus entering the lung should also be blocked to prevent serious accidents occurring as a result of vago-vagal reflexes set up by trauma in this region. The anesthesia should be deepened just before the pleura is opened to prevent the reaction to this stimulation, and again before the bronchus is cut across in pneumonectomy and lobectomy where individual ligation is possible, as it is open for a variable length of time and the composition of the anesthetic mixture cannot be maintained. In particularly wet cases of bronchiectasis or in cases where there is considerable hemorrhage, it is desirable to isolate and sever the bronchus at the earliest possible moment in order to prevent drowning of the other lung or obstruction to the airway. Very often this is not possible, as the hilus is obscured by dense adhesions and must of necessity be developed from the periphery and amputated behind a tourniquet.

The different types of cardiac surgery present various requirements as to the type of anesthesia. Undoubtedly a general anesthesia with cyclopropane as the agent is the one of choice in a majority of these operations. Whether or not intratracheal intubation should be used, is a controversial question and is more a matter of individual choice, and may depend on the adeptness of the anesthetist in its use. The cyclopropane should be supplemented by topical applications of 5 per cent novocaine to the areas of the heart which are being attacked at the moment. This prevents aberrant stimulation of the myocardium and will lessen the danger of ventricular fibrillation. Injection of ½ per cent novocaine into the myocardium will also prevent ventricular fibrillation and even stop it if used immediately, therefore a loaded syringe should be kept at hand. Drainage of an empyema of the pericardial sac can be accomplished by the use of local anesthesia alone. Penetrating wounds of the heart which necessitate immediate and rapid interference, require a rapidly induced general anesthesia, as time does not permit the use of local anesthesia. Cyclopropane is again the agent of choice because of its rapid induction and the desirability of high oxygenation of the blood in a patient whose circulation is dangerously impaired.

Positive pressure may be required for a short period during closure in cardiac cases, because of the practice of making an opening into the left pleural cavity to provide a route of drainage for the serous pericardial effusion which results after these operations. It is not desirable or necessary to leave a large pneumothorax, therefore after the opening into the pleura has been established, positive pressure is applied to expand the left lung and expel all the air possible from the cavity. This is only necessary for a few minutes, until the wound is closed tightly, and may be accomplished by means of a tight-fitting face mask.

Postoperative Care

Patients having been subjected to thoracic surgical procedures require the most minute and painstaking after-care. It is extremely important that all pulmonary and bronchial secretions be expelled. If the patient is unable to clear the tracheobronchial

tree by coughing, then either intratracheal catheter suction or bronchoscopy must be resorted to. These patients are kept in the Trendelenberg position for six to twenty-four hours for the purpose of aiding endobronchial drainage as well as for treatment of shock. They should be kept warm, and sufficient fluids given to restore the total amount lost, accompanied by the judicious use of transfusions. No morphine should be given until the patient has completely regained all of his faculties, and then only enough to relieve pain. A majority of patients will require oxygen therapy, and it has been found that the nasal catheter is the most efficient method in the average hospital. Oxygen tents are advantageous in some instances, but require more specialized knowledge and attention to keep them functioning efficiently than is usually available. The B.L.B. mask is not very satisfactory for prolonged use.

The physiology of the circulatory and respiratory systems of these patients has been seriously tampered with, therefore they must be watched carefully, and adjustments made from time to time in an effort to correct harmful conditions before they become irrevocable.

Summary

1. Advances in the field of anesthesiology have given great impetus to the recent advancement of thoracic surgery.

2. The development of the technique of intratracheal intubation in anesthesia has made previously formidable operative procedures now safe and feasible.

3. Cyclopropane approximates very closely the requirements for the perfect anesthetic agent, and is the agent of choice, in conjunction with novocaine, for all thoracic surgical procedures.

4. The preoperative and postoperative care of patients requiring thoracic surgery is extremely important.

5. Preferred techniques of anesthesia are outlined briefly.

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FRONT LINE ANESTHESIA

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In December, 1914, Dr. George Crile left Cleveland with a small unit of doctors, nurses and anesthetists (Miss Agatha Hodgins accompanied this unit as anesthetist) to serve at the American Ambulance Hospital at Neuilly, France. Dr. Crile returned to the United States within two months. The unit remained in active service at Neuilly for several months, after which time they returned to the United States.

When Dr. Crile returned to the United States, he presented to the Surgeon-General a plan to form hospital units for service abroad composed of doctors, nurses and anesthetists who were accustomed to working together in civilian hospitals. This plan was adopted early in 1915, and units were organized throughout the country in the leading hospital centers. The Lakeside Hospital Unit was designated as "Base Hospital No. 4." During the summer of 1915, enrollment of doctors, nurses and anesthetists was completed. All nurses and anesthetists were enrolled in the Red Cross, ready for induction into the United States Army.

War was declared by the United States on April 6, 1917. Immediate preparations were put in motion to assemble the unit. Miss Hodgins decided not to accompany the unit at this time as anesthetist, but to remain at her post as Director of the School of Anesthesia at Lakeside Hospital in order to train as many nurse anesthetists as possible for military service.

I had the honor to be appointed chief anesthetist of the unit. Miss Cunningham, nurse anesthetist, and Dr. Sykes (D.D.S.), were the other members of our anesthesia staff. Enlisted men, all volunteers, most of whom were students at Western Reserve University, were enrolled at this time to serve as orderlies.

We were equipped with several gas machines and a quantity of nitrous oxide and oxygen cylinders. Arrangements were made to ship nitrous oxide to us at intervals; oxygen cylinders to be refilled in France and England. Other anesthesia equipment and supplies were to be furnished by the British Military Hospitals, with whom we were to serve.

The honor of being the first military unit to leave the United States for overseas service was conferred upon Dr. Crile in recognition of his plan for hospital units. Our preparations for departure were of the whirlwind variety. We were to leave Cleveland on Sunday, May 6, 1917, in the afternoon. Many scheduled operations were awaiting Dr. Crile and Dr. Lower, so we all worked up to noon of that Sunday. During the two weeks preceding this date, we had had various inoculations of vaccines, et cetera, which, needless to say, did not add to our comfort.

On Sunday, May 6th, at 4:00 P.M. we left Cleveland, on a Pennsylvania Railroad special train. The nurses were in civilian clothes, as our uniforms had not yet been delivered. We were sworn into the Army en route. Two regular Army medical officers accompanied us, Major Gilchrist as commanding officer, and Captain Tuttle as adjutant. The following morning we arrived at Hoboken pier and immediately boarded a Cunard Liner.

We remained at the pier, aboard ship, for about three days. Here Red Cross capes and hats were furnished to the nurses, so we sailed still in civilian clothes, plus the Red Cross cape.

The trip across the Atlantic was uneventful. Boat drill, with life preservers adjusted, was held daily. Our ship was not convoyed.

Two days before landing we were met by the United States Destroyer No. 60—such cheering and rejoicing when this saucy little destroyer hove in sight. We landed at Liverpool on a bleak morning, and were met by a group of British officers. There was much consternation among them when they discovered women with the unit—they had expected medical officers only.

For that day and night, we remained at a Liverpool hotel. The chintz drapes, the huge beds and open grate fires in the bedrooms were a delight to us. Next morning we entrained for London. En route we were introduced to the English tea basket. These baskets were put aboard the train about noontime, and contained sandwiches, fruit, cake and a pot of hot tea, wrapped in its chintz cozy. Such a delightful innovation to us travelers.

Upon our arrival in London, we were escorted to hotels, where we remained for several days.

The greeting on all sides was "Hello, Yank." Our ego was tremendously expanded during our London sojourn, everyone was so delighted to have us with them. We visited all the large London hospitals and had our first introduction to war wounded. The Canadian soldiers claimed us as close relatives, as many of them had lived in the United States.

Mr. Page, the United States Ambassador, gave a tea in our honor at the United States Embassy. Here we met Lady Randolph Churchill, the American-born mother of the Honorable Winston Churchill. Mr. Page was a most charming man, and none of us has ever forgotten the afternoon spent as his guests.

We were received by King George and Queen Mary at a reception held on a lovely spring day in the garden of Buckingham Palace. The then Prince of Wales and Princess Mary were also in the receiving line. King George was delightful—such twinkling, friendly blue eyes; and Queen Mary was really beautiful, charming and gracious. Queen Alexandra held a reception and tea at Marlborough House for us one afternoon. She was a bit of Dresden china—fragile, gracious, unforgettable.

London was crowded with soldiers of all descriptions. Uniforms of all kinds were everywhere, a sight to make one realize Britain's far-flung empire. The wounded were coming back from the war, and fresh replacements entraining, loaded with full equipment, off to the wars—something caught at your heartstrings when you saw them leaving. The men home on leave, perhaps for the first time in two or three years, knew they were going back when their little holiday ended. London was a wonderful experience that we left with regret, but we too went on to war.

We sailed on a little hospital ship one dark night from Southampton, occupying the cots that brought the wounded back to England. All slept with life preservers adjusted and the channel behaved very badly, as usual. In the morning we were in the harbor of Le Havre, France, at the mouth of the Seine River. All day we sailed up the Seine on our hospital ship. It was May, apple-blossom time in Normandy; France was at her loveliest. Along the river route

Reception by King and Queen at Buckingham Palace May 18, 1917

the French peasants greeted us, so we entered into and fell in love with France. We docked at Rouen, an ancient city dating back to the Roman period—the historic town in which Joan d'Arc was burned at the stake.

Colonel Crile, who had preceded us from London, met us on the quay at Rouen with a group of British officers. We marched for a few miles through the town, still in mufti plus the Red Cross capes, the populace enthusiastically greeting us en route. Ambulances (the conveyances used on all fronts for human transport needs) met us and drove us to our base hospital some few miles outside the town of Rouen. This was a large British hospital center, as well as a military training ground. One of Napoleon's old training fields was again serving the same purpose. We arrived at Base Hospital No. 9 in the late afternoon. A small staff of British medical officers and nursing sisters (as nurses are called in the British Army) had remained to initiate us, so we were greeted by them and shown to our quarters.

Near this hospital were a number of rough board buildings, known in the British Army as "huts." The huts used for the wounded each had from twenty-five to forty beds, with kitchens and preparation rooms located at one end. The nurses' section, or compound, included several of these huts. A narrow hall ran the length of the nurses' huts on one side, about eight rooms opening off this hall, and two nurses were assigned to each room. Kerosene stoves served as heating units. Each occupant had her own wash basin and water pitcher. On winter mornings, our water was frozen and was thawed out on top of the kerosene stoves. A chapter could be devoted to the subject of kerosene stoves and the fuel supply alone. The issue of kerosene was one quart a day, but a good soldier always finds a way to provide necessi-

ties for himself. Two or three five-gallon tins of kerosene stored under one's cot was something to share with your friends and not to ask questions about.

The nurses' mess hall had a dining room and a sitting room. Here we were introduced to the gift of the British for living graciously under adversity. The sitting room was gay with chintz drapes and pillows and all sorts of improvised furniture. Bowls filled with the marvelous wild-flowers of France were everywhere, a bit of homey atmosphere as a refuge in the midst of chaos. Here tea was served every afternoon to nurses and officers,—a custom we all learned to enjoy and appreciate.

In this hospital we settled down to work. Uniforms were issued to the nurses, and at last we were in military regalia. After the major battles at the front, the convoys of wounded began to arrive. They had first been taken care of at the Casualty Clearing Stations (known as C. C. S's) — the first hospitals some few miles back from the fighting fronts, then loaded on hospital trains and brought to the base hospital sectors. From the trains they were convoyed by ambulance to the base hospitals. Surgery at the base hospital was of a more extensive type;—s h a t t e r e d bones, removal of shrapnel fragments, the investigation of abdominal wounds, chest surgery, and the sometimes extensive excision of tissues involved in gas gangrene cases. Patients with facial injuries were sent to special hospitals reserved for that type of injury only.

Nitrous oxide and oxygen was a perfect anesthetic for the type of surgery performed at the base hospital. The abdominal injuries were practically the only ones calling for relaxation. Shattered legs and arms had extensive areas of trauma that furnished a local block, and a very light inhalation anesthesia was all that was necessary. Soon we realized that our precious nitrous oxide must be conserved for the badly wounded patients and those in shock, consequently ether was used for the less seriously wounded. The British were using a considerable amount of chloroform, especially for induction preceding ether. This was an opportunity for us to become familiar with chloroform, and for short surgical procedures where only analgesia was necessary, it did prove most satisfactory.

After six weeks at Base Hospital No. 9, two operating teams (each consisting of a surgeon, anesthetist, nurse, and orderly) were appointed to proceed to the front to serve in a Casualty Clearing Station. Before leaving, we were given a course of instruction at a war gas school in preparation for possible gas attacks at front line posts.

We left by ambulance one Sunday morning, with Colonel Crile and Major Lower as surgeons, and two anesthetists, two nurses and two orderlies. All day we rode through the lovely land of France. As we approached the advanced areas, the roads were crowded with military conveyances of all kinds; soldiers were everywhere. At dusk we arrived at a Casualty Clearing Station, housed in tents. These C. C. S's were mobile hospitals, advancing and retreating with the armies. About an hour later a bombing raid was in progress. The anti-aircraft guns went into action—my first introduction to shell fire. Curious to see what the racket was all about, I went outside, had a tin helmet slapped on my head by a "Tommy" guard, and was told what sort of calamity such indiscretion led to. So right here was the first lesson on how to be a really good soldier.

Next morning at this C. C. S. we saw a tent filled with mustard gas victims. Their faces and hands showed great blisters, their eyes were extensively inflamed, and their breathing labored—a sight etched on one's memory for all time.

In the dark and confusion of overburdened military roads, we had been taken to the wrong C. C. S., so away again for another sector. The C. C. S. to which we were assigned was located about a mile from Ypres ("Wipers" to the British Tommies), in Belgium. These C. C. S's were arranged in groups of fours, two on each side of a railroad track, and the hospital trains used these tracks for the evacuation of the wounded. A wooden hut served as a surgery; everything else, with the exception of mess halls for officers and nurses, was under tents. A large marquee tent, sectioned off into cubicles, housed the nursing sisters. Hot water was supplied from a huge caldron set on a stove out in the open. Batmen brought a pitcher of hot water and a cup of hot tea when they called us, night or day, to go on duty—a nice little service. These batmen were men convalescing from wounds, not fit as yet for active service, but doing their bit at light work until they were well again.

Work at a Casualty Clearing Station came in great waves after major battles, with intervals between of very little to do. This was the summer of the long and bloody struggle for Pacchendale Ridge. Barrages of gun fire would rock the sector for days, then convoys of wounded would begin to arrive by ambulance. Night and day this ceaseless stream kept coming on. Walking wounded were taken care of in a special tent and evacuated immediately by hospital train.

In a receiving tent, the stretcher cases were assembled, stripped of their clothing and dressed in clean, new pajamas. The seriously wounded, especially the ones in severe shock, were taken to a special ward, given blood transfusions and other treatments in preparation for surgery later. From the receiving tent, the wounded were brought to the surgery, put on the operating tables stretcher and all, given an anesthetic, operated upon, picked up on their stretcher, and loaded on hospital trains for evacuation to base hospitals.

Surgery huts each had about eight operating tables, arranged lengthwise, four on each side of the hut. Shelves ran along the walls which served as tables for instruments, sterile dressings, et cetera. Each operating team worked as a unit, were responsible for their equipment, and alternated on day and night shifts.

Ether and chloroform were the anesthetics used by the British. We had brought a supply of anesthetic gases along with us from our base and one gas machine (quite a curiosity over there at that time). On one memorable occasion, when overtaken with an inundation of wounded, with Dr. Lower as surgeon, I gave forty nitrous oxide-oxygen anesthesias in a twenty-four hour stretch of duty. For that record, we gathered a bit of fame for ourselves and gas anesthesia.

Fatigue, overwhelming and profound, was the anesthetist's ally here in this front line area. After extensive battles, the wounded arrived in a state of utter exhaustion. Most of them were in a deep sleep when carried into the surgery; many did not even react when ether was administered. Others would be in a state of high excitement, difficult to control.

Surgery was of all types, with many shattered limbs. All one's attention had to be focused on caring

for the wounded and not on the shocking sights encountered. All the wounded had been given antitetanic vaccine at the field hospitals, and the shattered limbs had been put in Thomas splints for transportation to the C. C. S. Tags, on a cord around the soldier's neck, showed the man's name and regiment, as well as vaccines and drugs which had been administered at the field hospital. No surgery was attempted at these field hospitals; first aid only was given. Wounded men who had been lying in shell holes for days in inaccessible areas, were a pathetic sight. They had been without food and often without water, and their wounds were frequently a moving mass of maggots. While not pretty to look at, these industrious little worms proved themselves a formidable foe to the spread of infection.

During the summer of 1917 the deliberate bombing of hospitals took place. Previously all combatants had left hospital areas unmolested. After this time bombing raids were a nightly occurrence when weather permitted. Surgery huts were blacked out with blankets at sundown, and operating teams on duty remained at their posts regardless of bombing raids. Frequently the lighting system was put out of commission during a raid and we carried on with flashlights. Our C. C. S. had several direct hits during that summer and fall, with casulties among our associates. A soldier learns to accept death as casually as he does life, and necessarily becomes, for the time, a fatalist. To quote the British Tommie, "If it has your number, sister, it gets you," a comforting philosophy under duress.

Summer rains in this sector were torrential at times. The C. C. S. was located in the midst of a Belgian hop field and mud was overwhelming. Duck boards throughout the camp provided sidewalk facilities. Here history was lived and the pace was fast. Life was thrilling, shocking — an experience never to be forgotten.

I contracted facial erysipelas during the winter and was sent back to an isolation hospital for several weeks, the first Yank patient in that sector. Everybody came to see me; I really had a wonderful time in that British isolation hospital. I returned via Amiens and Paris to our Base at Rouen. Very shortly, due to great advances made by the enemy, we were virtually a front line hospital. The enemy was at Amiens, uncomfortably close. The same ceaseless tide of wounded ebbed and flowed, and the wounded were cared for and evacuated to England as rapidly as possible. Always the military hospitals must be kept cleared for the next wave of wounded.

Additional personnel, both medical officers and nurses, had been added to our original unit by this time. We found ourselves very short of anesthetists, so we began training selected members from our nursing group, although facilities for teaching were limited. The medical officers most generously took over the teaching of chemistry, physiology, et cetera, to these pupils, while the anesthetists of the unit taught and supervised the actual administration of the anesthetic. Among our pupils we also had British nursing sisters. This plan worked out most satisfactorily. Later on, operating teams from our base were sent to American Army sectors, and anesthetists trained by us accompanied these teams.

Anesthesia in war is not so complicated, as a whole, as anesthesia in civil practice. The greatly shocked and the seriously wounded do require all the skill any anesthetist can give them, but the great majority of the

wounded require only very light and brief anesthesia.

In the present war, if I were going to serve as an anesthetist, I would like to have available a very generous supply of pentothal sodium for intravenous anesthesia. Properly used, it could supplant ether to a great extent, and it has the advantage of compactness, little weight and great efficiency. Also, I would like to have, if possible, a light weight, simple machine built with a soda-lime attachment to administer cyclopropane and oxygen. Judging by my past experience as related in this article, this set-up would take care of almost any sort of war wounded.

The Armistice overtook us while serving at our base in Rouen. Gradually, the wounded began to disappear, life became more or less social, leaves were granted, Paris was the Mecca for a holiday. Thoughts turned to the journey home, and conversation as to what we would have to eat when we reached the United States and the sort of clothes we would buy.

From Rouen we travelled to Vannes, a lovely, quaint little city in the heart of Brittany. We remained there about two weeks, then went on to Brest, to sail there on a small United Fruit Company ship. We enjoyed a peaceful journey home with a charming British skipper. We landed in New York and were taken to a hotel where, after several days, demobilization took place. We had served abroad for two years—a cherished experience, always very close to one's heart.

The British military hospital service was wonderfully organized. Their wounded were cared for most efficiently and tenderly. Having lived with them and worked with them through some very chaotic days and nights, I can only wish I could serve with them again through this, our present, greater and grimmer war.

CONVULSIONS UNDER ANESTHESIA

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Chicago

Read at the joint meeting of anesthetists of Illinois, Indiana, Michigan, and Wisconsin, held in Chicago, May 7 and 8, 1941.

During the last few years an increasing number of reports of deaths due to convulsions under anesthesia have appeared in the literature. I have studied one hundred and forty-three cases reported since 1927 (not including three cases from my own experience). In this series the mortality has been about 37 per cent, quite an astonishing figure. Compared with the thousands of operations performed under anesthesia, this is not large, but some method of prevention should be found. I shall attempt in this paper to point out some of the pertinent facts, in order to determine measures that will combat these convulsions successfully. The following reports include one of my own cases and two which occurred at St. Francis Hospital, Evanston, during the last three years.

Case 1.—A 22-year-old male was admitted July 22, 1939, complaining of pain in right lower quadrant, of five hours' duration. For three days previously he had had no appetite, was nauseated, and had experienced some generalized abdominal pain. He

had taken very little food or fluids, if any. Temperature on admission was 102. White blood cell count was 14,950; no differential made. The urine showed albumin 1 plus. Diagnosis of appendicitis was made and surgery advised.

Morphine 1/8 grain and atropine 1/150 grain were given one half hour before the operation, which was started at 2:15 P.M. The anesthetic was nitrous oxide-oxygen-ether. During the operation the pulse rate varied from 108 to 132.

No trouble was encountered until the peritoneum was being closed, at which time the anesthetist informed me that the patient was having a convulsion. The patient's skin was hot and dry, and soon became cyanotic. In spite of many drugs administered, the patient expired on the table at 3:15 P.M.

Case 2.—A 10-year-old female was admitted, complaining of acute abdominal pain in right lower quadrant of thirty-six hours' duration, with nausea and vomiting; no food or fluid intake for same period. The white blood cell count was 15,000; no differential made. The urine showed clumps of red blood cells and 6 to 10 white blood cells per high power field. A diagnosis of appendicitis was made, and operation performed on May 7, 1938.

Morphine 1/12 grain and atropine 1/400 grain were given one half hour before the operation, which was started at 2:20 P.M. The anesthetic was nitrous oxide-oxygen-ether. During the operation the pulse rate ranged from 95 to 120.

While the peritoneum was being closed, the muscles about the patient's face began to twitch and by the time the skin was closed the convulsions had become general. Coramine and morphine were given, and deep ether anesthesia, without effect. Oxygen and carbon dioxide were administered, and the air passages aspirated. Avertin anesthesia produced some improvement, but the pulse became weaker. Glucose 5 per cent in water was given, without result. The operation ended at 2:55 P.M. and the patient expired at 4:20 P.M.

Case 3.—A 32-month-old female was admitted on October 21, 1940, with a history of frequent sore throat, nasal discharge, mouth breathing and cough. Examination revealed a mitral murmur, and large tonsils. Results of urine tests were negative. Blood coagulation time was four minutes. Rectal temperature was 100; pulse rate 100 to 160. No food had been taken for forty-eight hours before admission. Patient was referred to surgery for tonsillectomy.

Premedication was codeine sulphate 1/6 grain and atropine 1/200 grain. Ether was administered for fifteen minutes. Immediately following the operation 250 cc. of saline solution was given by hypodermoclysis.

Nothing unusual was noted until 3:15 P.M., when twitchings developed about the patient's face, with profuse perspiration and pin-point pupils. The patient's temperature at 3:30 was 106.6; pulse rate 170.

The twitchings gradually became convulsive, and the temperature at 4:00 P.M. was 107.4. Fluids were given (blood transfusions) and sodium amytal intravenously. This treatment quieted the convulsions somewhat but did not relieve them completely. Calcium gluconate and oxygen were administered, without effect. The patient expired at 2:55 A.M.

Two of these cases were quite similar, while in the third the convulsions were delayed and may or may not have been related to the anesthesia. However, I believe this case simulated the first two in the following respects: (1) The patient had an ele-

vation of temperature; (2) Proper food or drink had not been taken for several hours preceding the operation, which no doubt produced dehydration. (3) The patient was given atropine and had ether anesthesia. (4) This case also occurred in the summer.

Previous to operation the patients in the first two cases were ill for several hours, with nausea and vomiting, and were unable to retain food or fluids. Both had an elevation of temperature, and were sent to surgery following a short preoperative period for medication. The operations were performed during the summer, when the operating room was naturally warmer than usual. Each patient took a good anesthetic. In both instances the convulsion started at the time of the closing of the peritoneum.

The operative procedures in these cases were not difficult. The appendix in each instance was acutely inflamed, with considerable peri-appendiceal peritonitis. No undue trauma was necessary — the peritoneum was relaxed, so that there was no pulling or tugging on it.

In reviewing the one hundred and forty-six cases, the following facts are outstanding:

1. Incidence: chiefly in children or younger adults (a few cases occurred in patients fifty years of age).
2. A septic condition was usually present (an acute appendix was the chief offender).
3. This was a most striking point: the twitching of the face started as the peritoneum was being closed.
4. A majority of these patients were taken to surgery with an elevation of temperature and accelerated pulse rate.
5. All had a history of nausea and vomiting, with inability to retain food or water for several hours before operation (accounting for the dehydration).
6. Nearly all cases occurred during the summer months. However, deaths have been reported in nearly all months of the year.

The anesthetic used in most cases was ether, or a combination of nitrous oxide and oxygen. Every type of anesthetic was used, including ethylene, cyclopropane and local.

Theories

Roseman has proved quite conclusively that ether convulsions are attributable to a neurotoxin, produced by some strains of streptococci, in amounts insufficient to cause spasm in the absence of anesthesia, but which in the course of general anesthesia suffices to incite the muscular spasms characteristic of this condition.

Mackenzie believes that these convulsions are caused by acute toxemia, with the anesthetic drug stimulating an increased circulation of toxin-laden blood to the brain.

Impurities in ether have been blamed, such as acetaldehyde, peroxides, ethyl sulphide, ketones, and alcohol. However, these impurities, if they do exist, are in such small quantities that they would not constitute a toxic dose. Then, too, ether from the same container has been used for other patients, without producing convulsions. Convulsions have also occurred when ether had not been employed as the anesthetic agent. I think we all agree that ether is by far the safest anesthetic in general use, and the fact that it is selected most often as an anesthetic for children and younger adults, may account for the blame attached to it in deaths due to convulsions.

Excess of carbon dioxide has been

cited as a factor. The results of research with rats, at the University of Wisconsin, demonstrated definitely that ether administered in the presence of toxic fever, and with the addition of 12 to 15 per cent of carbon dioxide, produced convulsions in 64 per cent of the cases, as shown by the following table:

Ether anesthesia (pyrexia present)	No convulsions
Ether anesthesia with the addition of 17 to 21 per cent carbon dioxide	No convulsions
Ether anesthesia (pyrexia present) with the addition of 7 to 12 per cent carbon dioxide	Convulsions in 50 per cent of cases
Ether anesthesia (pyrexia present) with the addition of 12 to 17 per cent carbon dioxide	Convulsions in 64 per cent of cases

Atropine comes in for its share of consideration, since it is used in almost every case in varying doses, from 1/500 grain to 1/75 grain. Doses of atropine have been known to produce convulsions, followed by paralysis, stupor, delirium, coma and death, preceded by circulatory and respiratory failure. It is also known that atropine has a tendency to dry up secretions, and this, accompanied by pyrexia, may be one of the causes of convulsions during or following anesthesia.

The fact that these cases occurred during the hot weather brings up a question regarding heat stroke as a contributing factor. The combination of external heat and pyrexia, plus toxemia, nervous apprehension, and ether, may stimulate the heat regulation center in the brain, giving rise to symptoms of heat stroke.

Symptoms

Twitching of the muscles of the face is noted. Pupils are widely dilated and globe is fixed. The twitching spreads to the muscles of the neck, shoulders and arms and finally to legs and abdomen. As it spreads, it becomes more active. Finally, violent sustained epileptiform convulsions occur, associated with cyanosis. Hyperpyrexia develops and the skin is dry and hot.

Following discontinuance of the anesthetic, recovery may be delayed. Recurrence of convulsions later, while in bed, may be noted. The patient may die on the operating table, or later from exhaustion, associated with deoxygenation or pulmonary congestion. The convulsions may disappear, but the patient may fail to regain consciousness, or may have repeated convulsions over a period of several days, usually resulting in death from exhaustion, or from bronchopneumonia.

Pathology

Lowenbery and Waggoner of the University of Michigan described the gross and microscopic changes in the brain following convulsions, as follows:

"Most of the neuropathology appeared in the cortex of the brain. There was a dissociation of the normal brain architecture and fragmentation of the pyramidal cells of the 2nd, 3rd, 5th and 6th layers of the cortex. Some perivascular hemorrhages were present. Degenerative changes were also discernible in the basal ganglia. In the cerebellum, the Purkinge cells manifested destruction." Together with multiple areas in the brain cortex, these findings were corroborated by Courville in 1936.

Treatment

Treatment should begin before operation; I believe that adequate pre-

operative care is most essential. Parenteral fluids should be given. An endeavor should be made to lower the temperature of the patient by sponging, also by enemata.

If atropine is used, the dose should not be large. Morphine should not be given in large doses to acutely ill children. Perhaps it would be better to eliminate the use of morphine and atropine and substitute a barbiturate.

The patient's nervous mechanism should have some consideration. Try to calm him by gaining his confidence and explaining away his fear and apprehension. I believe that this strain on the nervous system may have some influence.

Anesthetic

The type of anesthetic should be chosen with care. Some authors recommend local anesthesia, spinal, or avertin. If a general anesthetic is used, the choice should be made only after thoughtful consideration.

During the operation, the minimal amount of surgery should be done, with the utmost gentleness in handling the tissues, especially the peritoneum. It has been noted that it is during the closure of the peritoneum that most of these convulsions occur.

The anesthetist should not begin to lighten the anesthesia in this type of case, until the operation has been completed and the wound dressed. The patient should be kept on the table until he begins to awaken; for in the transportation stage some outside shock, such as sudden change in temperature, might be enough stimulus to incite a convulsion.

Treatment for the Convulsion Itself

Almost every kind of medication has been advised. Some recommend discontinuing the anesthetic immediately and the administration of carbon dioxide, high concentrations of oxygen, or a mixture of the two. Others advise deep anesthesia with the same drug used during the operation, or with chloroform. The best results have been obtained by giving sodium amytal intravenously, repeated in small doses.

Concentrated sugar solutions are administered intravenously, in the hope of reducing cerebral pressure by dehydration. The administration of calcium salts, such as calcium gluconate, seems to check the hyper-irritability of the neuromuscular apparatus, tending to relieve the carpopedal spasm of parathyroid deficiency.

Adrenalin is given in order to counteract any idiosyncrasy or allergy to the anesthetic drug. If a hypoglycemic state exists, the adrenalin will temporarily mobilize the glycogen reserve until sugar in some form is given.

In those cases where convulsive seizures last several days, all means available to protect the patient against exhaustion and pneumonia must be used, including transfusions, proper posture, nourishment and the like.

CONCLUSIONS

1. These cases should be studied carefully before operation, and adequate premedication given.
2. Great care should be used in selecting the proper anesthetic.
3. Atropine should be used with caution, and then only in small doses.
4. The anesthetist should not lighten the anesthesia until the operation is completed.
5. The minimal amount of surgery should be done, with extreme gentleness in handling the tissues.

I do not believe that any one factor is the sole cause of these convulsions, but that it is a combination of the many conditions I have enumerated. Further study of an experimental nature, by pathologists, physiologists, anesthetists and surgeons, will be necessary before any definite conclusions can be reached.

ANESTHESIA FOR MAJOR ABDOMINAL SURGERY

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Read at the annual meeting of the New York Association of Nurse Anesthetists, held in New York City, May 21-23, 1941.

The art and science of anesthesia have become quite complicated during the last few years. With the development of modern surgery and the new discoveries in anesthesia the anesthetist has come to play an important rôle in the operating room team.

Of all the diversified operative procedures, major abdominal surgery puts the anesthetist to the most severe test, since here she must cope not only with problems of anesthesia but also with many surgical conditions which frequently arise during the course of a major abdominal operation. It is of the utmost importance, therefore, that the anesthetist map out the course of action beforehand and make plans in advance for meeting any emergencies that may arise.

In this connection we cannot stress too strongly the necessity of a thorough acquaintance with the patient's condition preoperatively. It is through this knowledge that the anesthetist becomes aware of the complications that may arise and therefore is able to prepare to cope with them. The anesthetist must also take into consideration the amount of surgical interference contemplated.

Fortified by a knowledge of these facts the anesthetist can proceed to plan his task. The first consideration is the question of preliminary medication, which must conform to the patient's condition. A young, healthy adult will require a barbiturate and a dose of morphine and scopolamine, whereas an old, debilitated patient will do better with a small dose of morphine and atropine alone. The patient should have had a restful night before the operation and should be in a composed and semisomnolent condition when he is brought to the operating room. For the average adult patient nembutal grains 1½ given the night before and repeated about two hours before operation, with morphine grain 1/6 and atropine grain 1/150 one-half hour before operation, is about all that is required.

Choice of Anesthetic

Next in importance is the choice of the anesthetic. This must be governed by various factors, chief among which are the age of the patient, his physical condition, and the type and duration of the operation contemplated. Here keen judgment and long experience will guide the anesthetist in the selection of the agent or agents most suitable for the particular case. It must be said in advance that no drug of low potency, such as nitrous oxide or ethylene, will suffice for a major abdominal operation — these agents are useful only for induction. It is the more potent anesthetics — ether and cyclopropane — which must be resorted to in order to obtain the relaxation and the depth of anesthesia required for major abdominal surgery. Of the two, ether is the more ideal and safer anesthetic, but where its use is contraindicated, as in patients suffering from pulmonary disease, liver and kidney insufficiency or marked debility and sepsis, cyclopropane can be substituted with great

benefit to the patient. This drug has no deleterious effect upon the blood chemistry and can be used, therefore, in the presence of anemia, diabetes and other metabolic disturbances and in patients with mild cardiac disease. In patients with advanced heart disease and especially in auricular fibrillation this anesthetic, which in high concentration causes pulse irregularities, should not be employed.

The question of basic anesthesia frequently comes up for consideration. The value of avertin and rectal evipal is not appreciated fully by anesthetists. A nervous and apprehensive patient will benefit greatly from the quiet way in which these preparations put him to sleep in his bed away from the operating room. A vigorous young adult will be much more relaxed and will require appreciably less of the anesthetic agent when basic anesthesia is employed. A patient with mild cardiac disease will be spared the excitement and the strain of vomiting and retching during induction and upon recovery from the anesthesia. We all know the benefit to the patient with a toxic thyroid when he is spared excitement and fear of the operating room. On the other hand, patients with liver and kidney trouble or those suffering from anemia and arteriosclerosis do poorly under avertin.

Finally, spinal anesthesia has established its usefulness in major abdominal surgery — in fact many surgeons prefer it to any inhalation anesthetic. The marked relaxation and quietness of the intestines under spinal anesthesia, combined with the less injurious after-effects, recommend it especially in the presence of pulmonary disease and in diseases of the liver and kidneys.

Induction and Maintenance of Anesthesia

The induction must not be hurried but it should be a progressive one with the elimination of as much of the nitrogen in the closed system as possible so as to make the anesthetic mixture stronger and more effective. However, when cyclopropane is the anesthetic, this elimination of the nitrogen should not be practiced. The patient should be completely anesthetized, with the abolition of all eye movements and full relaxation before the surgeon is allowed to enter the abdomen. Once the peritoneum has been opened and exploration of the abdomen done the anesthesia can be lightened, but at no time should the patient be allowed to emerge from the second plane of the third stage.

In any operation, and more especially in major abdominal surgery, it is of the utmost importance that all the signs of anesthesia be observed carefully in order that the anesthetist may be aware at all times of any variation in the depth of the anesthesia, degree of relaxation, or condition of the patient. With the circle filter which is now in use in almost all operating rooms, no patient need get into an alarming condition due to arrest of respiration, since with rhythmic pressure upon the breathing bag the respiration can be restored quickly to normal and a fair amount of oxygen can be delivered to the lungs at a moment's notice. In other words, the anesthesia machine can be converted at any moment into a resuscitating apparatus.

When the pulse becomes irregular, especially if this is accompanied by a rise in rate, one must anticipate trouble. These symptoms might result from an overdose of the anesthetic or an insufficient amount of oxygen in the blood and heart muscle. Of course, loss of blood or a pre-existing myocarditis may be the underlying cause of an irregular and rapid pulse.

There are in addition a certain number of reflexes within the abdominal cavity which may turn a smooth anesthesia into a stormy one at any given

moment. It is a well known fact that disturbing reflexes, characterized by abdominal rigidity and marked drop in blood pressure, may be caused by visceral and mesenteric manipulations. Traction on the stomach and liver and interference in the region of the diaphragm may cause laryngeal spasm and even apnea.

Cyanosis should never be tolerated. The factors involved in cyanosis are many, but the most common are obstruction of the pharynx due to the tongue dropping backward or to laryngeal spasm. In the first instance there is a grunting noise which can be relieved easily by insertion of an airway. The second condition is manifested by a crowing sound and is more serious. In rare cases one must resort to emergency intratracheal intubation in order to avoid a catastrophe. Speaking of cyanosis, one must not be misled by a certain dusky color of the skin which is due to the administration of sulphanilamide previous to operation. The anesthetist should be aware of this situation before starting the anesthetic.

Complications and Their Treatment

I have spoken at large about arrest of respiration and cyanosis, which frequently disturb a smooth-going anesthesia. A less common complication is aspiration of vomitus or other foreign material into the trachea and bronchi. Vomiting is most likely to occur during induction or at emergence from anesthesia. Catastrophes from vomiting usually take place in patients who are rushed into the hospital for emergency operation. In some cases the patient does not tell the truth about the exact time he received the last meal. In others the anesthetist may be lured into false security by certainty in regard to the number of hours since the patient received food. The difficulty is that gastric activity in seriously ill or injured patients is greatly retarded and undigested food may remain in the stomach for many hours. If vomiting takes place, several particles or one large chunk of food may lodge in the trachea or bronchi and cause asphyxia.

Lavage of the stomach before operation is not always helpful, since the larger particles of food remain within the stomach. Nevertheless this should be done, and in some cases of intestinal obstruction the tube should be left within the stomach throughout the operation, and the position of the patient should be such that it will facilitate drainage. Should vomiting occur in emergency operations the head and shoulders of the patient should be pulled over the side of the table and the mouth kept open with a suction tube inside.

The aspiration of mucus, pus, blood, artificial teeth or other foreign bodies is very dangerous not only in its immediate consequences but also by reason of remote complications, such as pneumonia or lung abscess, which may develop after the operation.

Of other complications massive collapse of the lung is the most serious. This is caused either by an inactive type of respiration or by the occlusion of a large bronchial stem with subsequent absorption of the gases from the lung area which is supplied by this bronchus. Massive collapse may not be recognized until the operation is completed and the oxygen under the tension of the closed system is discontinued. The patient may die of anoxia during or immediately after the operation. Should the extent of the collapse be insufficient in itself to cause death, a condition of pneumonitis will probably develop shortly after the operation. This condition can be prevented in many cases by the institution of carbon dioxide hyperpnea at frequent intervals, with forceful pressure on the breathing bag to deliver an adequate supply of oxygen to keep the lungs inflated and oxygenated. Intratracheal

intubation is the best preventive of massive collapse.

Convulsions under anesthesia merit our attention. They may occur at any age but are more frequent in children. We do not know the cause and there is no special treatment for convulsions during anesthesia, other than to protect the patient from injuring himself and preventing anoxemia by a full supply of oxygen during the convulsions.

Hemorrhage and Shock

For practical purposes hemorrhage and shock are to be considered from the same angle. Both cause a drop in blood pressure, and a rise in pulse rate with a decrease in its volume. There is pallor, with a cold and clammy skin, and a concurrent cardiac anoxia develops. Without vigorous treatment this condition soon leads to a fatal result. To prevent shock the anesthetist should not keep the patient in a deeper plane of anesthesia than is required. Loss of body heat and moisture should be guarded against and high oxygen saturation maintained. In surgical procedures which are known to be shocking to the patient administration of an intravenous saline solution should be started before operation and in some cases of marked hemorrhage and shock transfusion should be resorted to.

Spinal Anesthesia

The fact that spinal anesthesia is very much in demand in major abdominal surgery can be attested by the number of operations which are performed under this type of anesthesia. Here again a difficult task confronts the anesthetist, whether a medical man who administers the spinal anesthetic himself, or a nurse who is called upon to watch the patient.

The induction of the spinal anesthesia is in itself only part of the job; the more difficult part falls upon the anesthetist who watches the patient during the operation. In the first place, all patients undergoing a major operation under spinal anesthesia should receive intravenous glucose solution, started as soon as the anesthesia begins. The presence of the needle in the vein makes it convenient for the introduction of any other types of medication which may be required in emergency. Such treatment may be necessary when there is a marked drop in blood pressure which can be counteracted by the injection of ephedrin or neosynephrin. Also coramine and metrazol can be administered when the patient shows signs of exhaustion, with respiratory and cardiac depression.

In the same manner, when required, supplementary anesthesia may be given through the intravenous tube. A dose of morphine will quiet a restless patient, and a dose of 3 to 5 cc. of pentothal or evipal sodium will tide a patient over for a short period in cases where the spinal anesthetic begins to wear off or where it is desired to stop retching and vomiting during the operation.

In addition, inhalation of carbon dioxide and oxygen should be given in cases of high intercostal paralysis with respiratory depression. Also inhalation anesthesia of cyclopropane and oxygen may be administered whenever that becomes necessary. In such event the surgeon should stop the operation, cover the wound and wait until the patient is asleep and completely relaxed.

No patient to whom a spinal anesthesia has just been administered should be put into extreme Trendelenburg position. This position is especially dangerous in patients with cardiac disease and obese individuals. Where there is intra-abdominal pressure, as in cases of large ovarian cyst or uterine fibroid, and in cesarean section, or in patients with ascites, the Trendelenberg position should not be used at all. The danger from intra-abdominal pressure comes from a relaxed diaphragm

in high anesthesia. With the diaphragm offering no resistance, the pressure may be exerted against the heart and cause instant death.

The successful outcome of any major operation depends in large part upon a smoothly conducted anesthesia. The smoothness of the anesthesia is greatly enhanced by careful attention to details, such as preliminary medication, choice of the anesthetic, method of administration and timely anticipation of emergencies. It is only through such efforts on the part of the anesthetist that the art and science of anesthesia can achieve any success and occupy a place of honor in the surgical armamentarium.

DEPARTMENT OF EDUCATION

CARBON DIOXIDE AND ITS PHYSIOLOGICAL ACTION

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History

Carbon dioxide was discovered by Van Helmont in the seventeenth century, and the English scientist, Michael Faraday, in the nineteenth century, was the first to liquify it. Apparently no therapeutic use was made of it until J. S. Haldane and Yandell Henderson observed its value as a powerful stimulant, in 1925 and 1926. Since publication of the findings of these two noted physiologists, carbon dioxide has not only been administered effectively with most gratifying results, but also it has been shamefully abused. At the present time there are two schools of thought, one group approving its use for almost all conditions causing respiratory depression or failure, the other disagreeing with this concept and being of the opinion that the blood as well as the vital centers already have an excessive amount of carbon dioxide during a period of respiratory depression; therefore carbon dioxide should not be administered.

Where Found

Air contains approximately 0.04 per cent of carbon dioxide while a poorly ventilated room may contain nine to ten times that concentration. The concentration is likewise greater in the air of cities than in that of the country. Carbon dioxide is formed in the soil, and issues from surface fissures in many parts of the earth's crust, as in Java, Italy, and Yellowstone Park. In the animal body, carbon dioxide is formed by the combustion of organic acids with a liberal supply of oxygen. It is therefore considered a product of tissue metabolism, and it is carried from these tissue cells by the venous blood.

Uses

Carbon dioxide may be found in the form of a gas, a liquid, or a solid. As a gas it is used:

1. to stimulate the respiratory center
2. by green plants to make carbohydrates, fats, and protein
3. in fire extinguishers
4. in carbonated beverages.

As a solid, in the form of dry ice, it is used:

1. to preserve foods by keeping them cold
2. to cool and humidify properly the oxygen in oxygen tents.

Properties

1. Colorless, tasteless, odorless gas
2. Specific gravity of the gas is 1.53 (air = 1.0), or one and one half times as heavy as air
3. Liquefies at 30.9°C. at 77 atmospheres (approximately 1150 pounds pressure)
4. Solidifies at -78°C. by spontaneous evaporation of the liquid, forming a white, snow-like solid

5. Molecular weight is 44.00. The carbon dioxide molecule contains two atoms of oxygen, the atomic weight of oxygen being 16 for each atom; and one atom of carbon with an atomic weight of 12.
6. Absorption coefficient is 1.71. This is the quantity of carbon dioxide which can be obsorbed by 1 cc. of water at 760 millimeters of mercury (atmospheric pressure at sea level). If dissolved solid substances are in the water, the absorption coefficient of any gas will be reduced. Thus the coefficient of absorption of carbon dioxide in plasma at body temperature is 0.510, and of oxygen is 0.024. Its solubility increases proportionately with increase in pressure.
7. Diffusion rate of carbon dioxide is about thirty times greater than that of oxygen.
8. Neither burns nor supports combustion.
9. Absorbed by alkalis; turns lime water milky.
10. Readily unites with water to form carbonic acid. This weak acid in turn can react with bases to form carbonates.
11. The partial pressure of carbon dioxide in inspired air is 0.30 millimeters of mercury, in expired air is 28.5 millimeters of mercury, and in alveolar air it is 40 millimeters of mercury. The carbon dioxide tension of the blood is essentially the same as alveolar air.

Test for Presence

A simple way to test for carbon dioxide is to blow exhaled air through a glass tube into a beaker of lime water (calcium hydroxide). At the end of the expiration, the point at which the carbon dioxide concentration is the greatest (5.5 per cent), the clear lime water will begin to turn milky. The production of milkiness in lime water is a characteristic of carbon dioxide and is caused by the formation of insoluble carbonate.

Carbon Dioxide in the Blood

Carbon dioxide is formed in the body as a result of metabolic processes. It is diffused from the intercellular spaces into the venous blood, and from the blood into the alveolar air. Each 100 cc. of blood contains about 40 to 60 cc. of carbon dioxide, depending on whether it is arterial or venous. Not much more than 2 cc. of this amount can be held in physical solution, the remainder being present in the form of a loose chemical combination with a base to form a bicarbonate or carbonate. This union is destroyed when a more powerful acid enters into competition with it. Oxyhemoglobin is stronger in acid than reduced hemoglobin. Therefore oxygen tends to displace carbon dioxide from the red cell in the pulmonary blood; and conversely, it has been shown that at equal partial pressures of carbon dioxide a greater amount of it is fixed by reduced oxygen than by oxygenated blood. This explains why carbon dioxide is added to the blood during its passage along the systemic capillaries.

The venous blood removes carbon dioxide from the tissues and liberates it into the alveolar air while being transported through the lungs. The average normal amount of carbon dioxide carried in venous blood is about 56 volumes per cent, which is approximately 6 volumes per cent higher than arterial blood. The major part of it is found in the plasma as sodium bicarbonate and a negligible amount is in physical solution. In the red cell, it is found as potassium bicarbonate and carbamino compounds.

The red cell membrane is not permeable to hemoglobin or to cations such as

potassium (K), and sodium (Na); but it is permeable to anions and to carbonic acid. As carbon dioxide leaves the tissues the following chain of events take place:

1. It diffuses into the blood plasma and thence into the red corpuscle where the carbonic anhydrase catalyzes it to carbonic acid:

$$CO_2 + H_2O = H_2CO_3$$

2. When it enters the red cell the carbonic acid dissociates into hydrogen and carbonate ions:

$$H_2CO_3 = H + HCO_3$$

3. It reacts with the potassium salt of hemoglobin (alkali) and potassium bicarbonate (alkaline) to form acid hemoglobin:

$$H + HCO_3 + KHb = KHCO_3 + HHb$$

4. The following ions are now present:
   In the plasma, sodium (Na), and chloride (Cl)
   In the corpuscle, potassium (K), and Hydrogen (H)
   Hemoglobin (Hb), and HCO_3
5. The anions then diffuse through the red cell membrane until an equilibrium is reached.
   a. HCO_3 leaves the red cell, combines with sodium of plasma to form sodium bicarbonate.

$$HCO_3 + Na = NaHCO_3$$

   b. The chloride which is given up by the sodium passes into the red cells. This is known as the chloride shift.
   c. Some carbon dioxide combines with NH_2 groups of the hemoglobin to form a carbamino compound.

$$Hb.\ NH_2 + CO_2 = HbNHCOOH$$

The following is the result of these biochemical changes when carbon dioxide enters the blood:

1. The chloride content of the plasma is lowered.
2. The bicarbonate content of the plasma and of the red cells is increased.
3. The chloride content of the red corpuscle rises.
4. The actual metallic content of the red cells and of the plasma is unchanged.

Carbon dioxide is eliminated principally by the lungs. Just how the carbon dioxide is given off is not definitely known. It is believed that the carbon dioxide added to the venous blood is carried as a bicarbonate in the red corpuscles and in the plasma. When the pulmonary blood contacts the higher oxygen concentration in the alveoli and takes up additional oxygen, the oxyhemoglobin liberates the carbonic acid (H_2CO_3) from the potassium bicarbonate ($KHCO_3$), and the carbonic anhydrase catalyzes the carbonic acid with the formation of carbon dioxide. This is an opposite reaction to that which takes place when the carbon dioxide from the tissues enters the venous blood.

The measurement of the available alkali present in the blood is termed the CO_2 combining power. The reaction of the blood appears to remain rather constant in spite of the active and constant interchange of carbon dioxide taking place between the blood and the tissues. Tissue oxidation produces carbon dioxide, which tends to raise the hydrogen ion concentration. If the hydrogen ions are in excess the solution is acid. The uniform reaction of the blood is

maintained partly by the presence of buffers in the blood and tissues, and partly by the regulating action of the lungs and kidneys which promptly excrete the excess anions as carbon dioxide and various salts.

The blood buffers protect the reaction of the blood from the effects of acids. When an acid such as hydrochloric is added to water the reaction becomes markedly acid, since all strong acids liberate many hydrogen ions. If a weak acid (phosphoric or carbonic) is added, the reaction will be less acid because relatively fewer hydrogen ions are dissociated. Sodium bicarbonate will react with stronger acids (HCL) by liberating carbonic acid; therefore fewer hydrogen ions will be dissociated. The reaction is expressed as follows:

$$HCL + NaHCO_3 = NaCL + H_2CO_3$$

In this reaction three things have happened:

1. The very strong acid — hydrochloric — has disappeared, the very weak acid — carbonic — having taken its place.
2. The weak carbonic acid is volatile and is eliminated quickly by diffusion into the alveolar air. This continues until equilibrium has been re-established between the pressure of gas in the alveoli and that in the blood.
3. The bicarbonate has served as a reserve of base which has buffered the added acid. The bicarbonate has been reduced and finally used completely in the process.

Sodium bicarbonate constitutes the main buffer of blood plasma, and the amount of sodium present constitutes the CO_2 combining power or alkaline reserve. It represents the amount of alkali that is available for the neutralization of stronger acids.

The normal CO_2 combining power, as mentioned above, ranges from 40 to 60 volumes per cent. An increase in acid production may not change the reaction of the blood owing to the protective mechanisms just described; but it will tend to reduce the amount of protective sodium bicarbonate, changing it to carbon dioxide, which is eliminated by the lungs. There is then a diminution of alkaline reserve, or the CO_2 combining power has been lowered. This condition is spoken of as "acidosis," even though the blood is still alkaline in reaction.

Acidosis may accompany many pathological conditions such as diabetes, where there is an increase in acid formation (ketone bodies); nephritis, where the excretory function is inhibited; and diarrhea because of a direct loss of alkali.

An increase in CO_2 combining power is termed "alkalosis." This may occur from lowering the hydrogen ion concentration by excessive intake of bicarbonates. Hyperpnea may cause alkalosis by removing large amounts of carbon dioxide from the lungs. Loss of hydrochloric acid and other acids from the body, as in severe vomiting, may produce the same result.

Another method of determining the reaction of the blood is to ascertain directly the blood concentration of hydrogen ions, using a potentiometer. Actually the hydrogen ion concentration of the body fluids varies very little. A pH of 6.9 to 7.8 represents the greatest variation compatible with life. Under ordinary circumstances of health the range is between 7.22 and 7.55, with the average considered as 7.4. As hydrogen ions increase, the pH will fall and with the lowering of hydrogen ion concentration the pH will rise. Therefore with a fall

in the blood pH there will be a corresponding fall in the CO_2 combining power, and vice versa. There may be a marked change in the alkali reserve, however, with little or no change in the pH. In disease, the pH of the blood never becomes actually acid (that is, a pH below 7.0).

A patient's alkaline reserve is important to the anesthetist. Some anesthetics reduce the CO_2 combining power; consequently, in the presence of an existing acidosis, none of these would be considered the anesthetic of choice.

Pharmacological Effects

Respiration: The effect of carbon dioxide on the respiratory center depends upon at least two main factors: (1) the strength of the stimulus, and (2) the sensitivity, or excitability of the respiratory center. Carbon dioxide is considered the principal chemical stimulus to respiration, either directly or through pH.

Carbon dioxide regulates the respiratory depth and rate by stimulating the medullary center. A rise of 2 per cent of carbon dioxide in the inspired air tends to increase the volume of air breathed by 50 per cent, and an increase of 5 per cent may increase the minute volume as much as 500 per cent by increasing both the rapidity and depth.

Toxic concentrations will be manifested by irregular and convulsive respirations, the inspirations being shallow and weak, the expirations powerful and prolonged. Paralysis of the medullary center has been brought about by the cumulative action of carbon dioxide administered in a concentration of 30 to 35 per cent.

A reduction in the normal amount of carbon dioxide in the blood (acapnia) may produce an apnea. This condition may be brought about by hyperpnea caused by (1) anoxia, (2) excitement or fear, as found particularly in children during the induction period of an anesthesia, and (3) after the administration of any therapeutic or anesthetic gas under positive pressure when the exhaled carbon dioxide is completely removed by soda lime, or when there is absolutely no rebreathing of the exhaled gases through the anesthesia machine.

Bronchial muscle is constricted by moderate concentrations but relaxed by high concentrations of carbon dioxide.

Blood Pressure and Pulse: A slight increase in the alveolar carbon dioxide increases the venous return, even when the arterial pressure is little affected, and the pulse becomes stronger and more rapid. The increased venous return would increase the diastolic filling and thus the efficiency of the heart.

The experimental work with carbon dioxide on anesthetized dogs done by Behnke showed a fall in blood pressure of 40 millimeters of mercury over a period of thirty minutes.[1] At the end of this time, the carbon dioxide concentration accumulating in the lungs was 20 per cent. As the dogs continued to rebreathe the mixture, increasing the percentage up to 30, the blood pressure was incrased markedly.

Leake and Waters found that in dogs concentrations of 10 to 20 per cent of carbon dioxide in 90 to 80 per cent of oxygen produced a great rise in blood pressure, and a considerable elevation in pulse rate. In 30 per cent concentration (which approaches the anesthetic or unconscious range) the blood

[1] Behnke, A. R., "Certain Physiological Principles Underlying Resuscitation and Oxygen Therapy." *Anesthesiology*, May, 1941, 2:245.

pressure and pulse were more nearly normal. Blood pressure decreased and the pulse became slow with concentrations above 40 per cent.[2]

When serious toxic effects appear, the ventricular rate will be slowed because of heart block, due to poisoning of the bundle of His. The heart, however, continues to beat weakly for several minutes after the respirations have stopped.

Carotid Body: The chemoreceptors in the carotid and aortic arch bodies are sensitive, though not as markedly as the respiratory center, to high tensions of carbon dioxide in the arterial blood, although they are stimulated by anoxia, which causes an increase in the respiratory rate.

Coagulation Time: A slight increase in the alveolar carbon dioxide concentration shortens the coagulation time.

Muscles: During exercise the carbon dioxide content of the skeletal muscles and blood is increased. The carbon dioxide which is produced during activity affects the circulation in two ways: (1) by dilating the vessels in the muscles, and (2) by stimulating the vasoconstrictor center and reducing the supply of blood to the viscera and skin and allowing a greater amount for the muscles, to supply the needed oxygen.

Muscular twitchings and clonic convulsions may follow a ten to fifteen minute administration of a mixture of 30 per cent carbon dioxide and 70 per cent oxygen. The stimulating effect will pass later into depression, with a loss of reflexes.

Pupils: Toxic concentrations stimulate the pupillo-dilator center.

Peristalsis: Stimulating concentrations increase peristalsis.

Skin: Baths containing carbonic acid cause a slight reddening of the skin. Skin that is cyanotic because of anoxia should return to normal color when oxygen is administered with carbon dioxide, particularly if the cyanosis is due to a depressed respiratory center. Toxic concentrations of carbon dioxide cause pallor.

A small amount of carbon dioxide (7 to 8 grams in twenty-four hours) is excreted from the skin.

Mouth and Stomach: Fluids containing carbonic acid (CO_2 charged water) induce reddening of the mucous membrane of the mouth and stomach. This slight irritation tends to increase the appetite and to give a sense of well-being. Some of the carbonic acid is eliminated by eructation.

Urine: Solutions containing carbonic acid are absorbed very rapidly, and urine output is increased.

Glottis: Inhalations of 100 per cent carbon dioxide may cause spasm of the glottis.

CONCLUSION

I. The reaction of the blood is alkaline and is protected in three ways:
   a. by the buffers of the blood
   b. by the elimination of carbon dioxide through the lungs
   c. by elimination of non-volatile acids by the kidneys.

II. An increase of 10 per cent carbon dioxide in the inspired air stimulates the respiratory and vasomotor centers. As toxic concentrations approach—30 to 40 per cent—the vasomotor center is depressed and the cardio-inhibitory center is stimulated, at which time the blood pressure falls and the pulse becomes very slow and weak.

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[2] Leake, C. D., and Waters, R. M., "The Anesthetic Properties of Carbon Dioxide," *Anesthesia and Analgesia*, 8:17, 1929.

III. The sensitivity of the respiratory center is increased by fear, anger, pain, et cetera, consequently the normal amount of carbon dioxide in the blood causes hyperpnea, which will be followed by acapnia, and apnea may then ensue.

IV. Apnea may also be caused by a respiratory center that is rendered less sensitive to carbon dioxide. Morphine and the barbiturates decrease the sensitivity of the center, requiring a greater amount of carbon dioxide to maintain a normal respiration.

V. It is essential that the anesthetist understand the patient's condition and the physiological action of carbon dioxide so that she may administer a carbon dioxide-oxygen mixture safely as well as effectively.

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QUESTIONS AND ANSWERS

Question No. 1 Who is responsible for placing the patient in the proper position on the operating table?

Ans. The surgeon's assistants may decide in which position the patient shall be placed upon the operating table in order to facilitate exposure of the operating field for the surgeon. The anesthetist should be entirely familiar with the positions necessary for any operation, however, and if the decision is left to her, should assume responsibility for seeing that the patient's position does not in any way cause injury, undue pressure, or interference with respiration or circulation. Any suggestions by the anesthetist regarding the welfare of the patient during operation are usually gratefully received by the members of the surgical team.

Sara Mullin
New York Hospital

Ans. The anesthetist.

Mae B. Cameron
Ravenswood Hospital, Chicago

Ans. The nurses are responsible, with directions from the anesthetist, for so placing the patient that respiration will not be embarrassed.

Miriam G. Shupp
Strong Mem'l Hospital, Rochester, N. Y.

Question No. 2 Who assigns the cases to the individual anesthetist?

Ans. The chief anesthetist usually assigns the cases to the individual anesthetists. Any choice of the surgeon for a particular anesthetist is given primary consideration whenever possible. In a large hospital employing nine or ten anesthetists, it is often most helpful to place staff anesthetists in charge of anesthesia for special units, such as E. N. T., gynecology, neurological surgery, et cetera. In this way everyone becomes entirely familiar with the work and the requirements of the surgeon in charge. This also increases teaching efficiency.

Sara Mullin

Ans. The anesthetist.

Mae B. Cameron

Ans. The chief anesthetist; this duty may be delegated to her assistant.

Miriam G. Shupp

Question No. 3 (a) How long must a student have been in the school before being assigned to night call?

Ans. Three weeks — always with a supervisor.

Mae B. Cameron

Ans. Four months.

Helen Lamb
Barnes Hospital, St. Louis

(b) Is a student at any time during her training ever allowed to assume full responsibility for cases at night?

Ans. No — a graduate anesthetist is always on duty with the student.

Mae B. Cameron

Ans. No student, either junior or senior, ever takes full responsibility at night for surgical cases, but is always directed by a staff supervisor. Sixth and seventh month students, however, do take one night of night calls without supervision, on the obstetrical service of an outside affiliated hospital.

Helen Lamb

(c) Give in detail your routine relative to student service on night duty.

Ans. Students are on call one week every fifth week. The last month of student's training she takes obstetrical cases alone. A graduate anesthetist is always available in the hospital if needed.

Mae B. Cameron

Ans. Junior students (fifth and sixth month) and senior students (seventh and eighth months) take night calls under the direction of a supervisor. Rotation of service is such that the juniors (fifth and sixth months) take from one to two nights of calls each week (divided between them) to introduce them to night emergency procedures. Seniors (seventh and eight months) take between them five to six nights of calls per week.

Under the foregoing plan, each junior student is assigned at least one night per week on call, and each senior student is assigned at least two nights per week on call.

Students who are to be on night call are released from duty as early as possible that day, after completion of the regular schedule. schedule.

Helen Lamb

Question No. 4 (a) How many anesthetists do you have on your staff?

Ans. Seven.

Miriam G. Shupp

Ans. Five.

Mary H. Snively

Duke University Hospital, Durham, N. C.

(b) How many take "night call" and how are they rotated?

Ans. Six.

Miriam G. Shupp

Ans. Three; each person is on call every third night, (1:00 P. M. to 7:00 A. M.), and every third week-end (1:00 P. M. Saturday to 7:00 A. M. Monday).

Mary H. Snively

(c) What time are they allowed off duty?

Ans. Two anesthetists are on call each night. The day of call they have no "time off duty" but go to their rooms as soon as schedule permits. Ordinarily the anesthetist on first call from 7:00 P. M. to 7:00 A. M. has most of the previous afternoon to rest. This anesthetist does not come over in the morning but is called when and if needed. The anesthetists go off duty at 12:00 noon of the day following night call.

The schedule is as follows:

Two anesthetists on call

Two anesthetists off duty at 12:00 noon

One anesthetist off duty 12:00 P. M. to 3:30 P. M., goes off duty at 7:00 P. M.

One anesthetist off duty at 3:30 P. M.

One — chief anesthetist — off duty at 4:00 P. M. or thereabouts.

The full staff covers the schedule until 12:00 noon, and four anesthetists from 12:00 noon to 3:30 P. M.; three anesthetists from 3:30 to 7:00 P. M.; two anesthetists from 7:00 P. M. to 7:00 A. M.
On the weeks they are to be on call over the week-end the anesthetists have only one other night call. If scheduled for a week-end off duty they take calls two nights during the week.

Miriam G. Shupp

Ans. The schedule runs a 21-day cycle as follows:

First seven days:

Monday and Thursday — half day beginning at 1:00 P. M.
Tuesday and Friday — on call
Wednesday and Saturday — subject to calls until 5:00 P. M.
Sunday — off duty

Second seven days:

Monday and Thursday — on call
Tuesday and Friday — subject to calls until 5:00 P. M.
Wednesday — half day beginning at 1:00 P. M.
Saturday and Sunday — off duty beginning Saturday at 1:00 P. M. until Monday at 7:00 A. M.

Third seven days:

Monday and Thursday — subject to calls until 5:00 P. M.
Tuesday and Friday — half day beginning at 1:00 P. M.
Wednesday, Saturday and Sunday — on call

Mary H. Snively

Question No. 5 (a) Who administers the intravenous anesthetics in your institution?

Ans. The nurse anesthetists. *Olive L. Berger*
Johns Hopkins Hospital, Baltimore

Ans. The anesthetists. *Lillian G. Baird*
University of Michigan Hospital, Ann Arbor

Ans. The senior quarter students and staff anesthetists. *Mary H. Snively*
Duke University Hospital, Durham, N. C.

Ans. The student anesthetists. *Sister Rudolpha*
St. John's Hospital, Springfield, Ill.

(b) Who inserts the intratracheal tube?

Ans. The nurse anesthetists. *Olive L. Berger*

Ans. The anesthetists. *Lillian G. Baird*

Ans. The senior quarter students (under supervision) and staff anesthetists. *Mary H. Snively*

Ans. The student anesthetists. *Sister Rudolpha*

(c) If administered by the anesthetist, have you found any difficulty in training the anesthetists to assume this responsibility?

Ans. No. *Olive L. Berger*

Ans. No. *Lillian G. Baird*

Ans. Certainly not. *Mary H. Snively*

Ans. None whatever. *Sister Rudolpha*

(d) How did your anesthetists obtain the necessary experience to do the intravenous and intratracheal procedures?

Ans. Those anesthetists who had not had previous experience with venipunctures were sent to the Luetic Clinic of the Out-Patient Department to be instructed. The first twenty-five pentothal sodium anesthetics were administered by the surgeon while the anesthetist watched the patient. Subsequently the anesthetists have administered the pentothal sodium anesthesias.

A length of small-bore rubber tubing is employed to connect the needle with the syringe, which is fitted with a three-way stopcock. This enables the anesthetist to administer the anesthetic, watch the patient and administer oxygen whenever desired.

The chief anesthetist was instructed by the chief of the bronchoscopy service in the introduction of the intratracheal catheter. She then trained her staff and students.

Olive L. Berger

Ans. At the time these procedures were introduced, a doctor was in charge of the department. He instructed the staff and they later carried on the instruction of the new staff members and the students.

Lillian G. Baird

Ans. 1. **Intravenous.** Venous puncture technique is secured by each new group of senior students and the staff, by drawing blood on clinic patients for Wasserman tests. Each person does about twenty venipunctures before attempting to do intravenous anesthesia in the operating room. The first cases are supervised carefully.

2. **Intratracheal.** Practice laryngoscopy is done first on N. E. T. "Service" cases. Then a few oro-tracheal and naso-tracheal intubations are done on simple cases before the difficult types are attempted.

Mary H. Snively

Ans. 1. **Intravenous:** by instruction and observation; by giving saline and glucose solutions intravenously to patients on the wards, and by actual practice under rigid supervision.

2 **Intratracheal:** by instruction and demonstration, and by actual practice on dogs and humans.

Sister Rudolpha

Question No. 6 (a) Who has charge of the oxygen service in your institution?

Ans. The Department of Anesthesia.

Aida B. Allwein
Mount Sinai Hospital, Cleveland

(b) Give any information you can relative to control of the service, especially as regards the maintenance of proper percentage in the tent.

Ans. Tents are checked four times daily by the anesthetist for oxygen concentration, temperature, humidity and rate of liter flow.

The Department of Anesthesia assumes responsibility for upkeep of oxygen therapy apparatus; delivery in good order to bedside; replacement of oxygen cylinders when empty, and storage after equipment has been cleaned and disinfected by the nursing service.

Subsequent observations are made by the Resident in Medicine for the purpose of supervision, to insure proper conditions of administration to suit the needs of the patient.

Aida B. Allwein

(c) In what percentage of cases is the oxygen administered by tent? By nasal catheter? By mask?

Ans. Tent 90 per cent; nasal catheter and funnel 4 per cent; mask 6 per cent. *Aida B. Allwein*

Question No. 7 (a) How often do you change the soda lime?

Ans. When indicated by carbon dioxide detector.

Sister Rudolpha

Ans. The length of time that we can use one charge of soda lime (4 x 8 mesh) varies (1st), with the type of canister; and (2nd), with the kinds of cases in which we use it. The remarks below will be confined to approximate averages. The Foregger and the McKesson circle filter canisters hold one pound of soda lime. These canisters of soda lime are used about six to seven hours. Each of the Heidbrink chambers holds more than a pound and one canister usually lasts about eight hours. There are occasions when we exceed these figures by a half hour to an hour. At other times it is necessary to change the soda lime sooner.

Esther C. Myers
Mount Carmel Mercy Hospital, Detroit, Mich.

(b) How do you control the change from one canister to another in order that the soda lime may not be wasted?

Ans. The carbon dioxide indicator again is the criterion.

Sister Rudolpha

(c) Do you have any method of reconditioning the soda lime? If so, how?

Ans. No. *Sister Rudolpha*

Ans. (b and c)

1. A fresh supply of soda lime in the circle filter is used about two and a half hours. It is then allowed to rest for an hour. At the end of this period it is used for another hour. The hour

rest period is repeated after each hour of use until (a) the seven or eight hour period is reached; and (b), when the patient shows signs of carbon dioxide accumulation. Dr. Adriani found that the "to and fro" filter may be used five hours before needing the first rest period.[1]

2. A piece of adhesive is attached to each canister to indicate the total amount of time the soda lime has been used. Two pieces of adhesive are used on canisters with the double chamber.

   After each anesthesia, the total time the soda lime was used is added to the last figures recorded on the adhesive. Example: If 2' 30" is recorded on the adhesive and the filter was again used for two anesthesias, each lasting forty minutes, the adhesive would show 3' 10" and the last figure would be 3' 50".

   The anesthetist who uses the soda lime and marks the adhesive, signs her initials after the record of the time.

3. After the day's anesthesias have been completed, the soda lime in each of the canisters is poured into a pan. The granules are mixed well and returned to the respective canisters. Each chamber in the double canister is handled separately.

4. **One-canister type (Foregger and McKesson):** Two small coffee cans are kept in the operating room with the Foregger and the McKesson machines. One can is empty, and the other contains either used or fresh soda lime. A piece of adhesive is on this full can indicating the number of hours it has been used.

   When the soda lime in either of these machines needs a rest period, it is poured into the empty can and the adhesive is taken from the outside of the machine canister and placed on the outside of the coffee can. In the event that the charge to be removed is exhausted instead of needing a rest, then fresh soda lime is put into the empty can and labeled with new adhesive. The soda lime which has been resting in the other can is then poured into the machine canister and the adhesive from this can is placed on the canister.

   Double chamber type (Foregger and Heidbrink): When the chamber that is being used needs a rest period it is turned off and the alternate chamber is turned on. At the time of complete exhaustion, a fresh supply of soda lime is put into the particular chamber and a clean piece of adhesive is placed on the outside of this chamber.

Esther C. Myers

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[1] Adriani, John: "Recent Developments in Carbon Dioxide Absorption." Bull. Amer. Ass'n Nurse Anesthetists, May, 1941, page 86.

ANESTHESIA: A CAREER FOR THE GRADUATE NURSE

The Nurse as Anesthetist

Anesthesia as a career for the graduate nurse has become of increasing interest and importance in recent years. It is now generally recognized in the hospital field that the nurse has many special qualifications for this work. Her training develops the requisite skill in careful observation of the condition of the patient. Her natural gentleness and sympathetic attitude, her aptitude for alert and conscientious attention to detail and for the deft and skillful use of the necessary apparatus and equipment, are all qualities especially useful in anesthesia. With additional experience after graduation, the poise and self-possession are acquired that prepare the nurse to exercise mature judgment in emergencies that may arise.

The duties of the anesthetist, while strenuous and demanding at times, are stimulating and varied. This field has a particular appeal for the progressive nurse who wishes to employ her talents where they will be of the greatest value.

The intelligent, capable and conscientious nurse who has taken the required special training in an approved School of Anesthesia is eligible for a position in a branch of hospital service that is of great value to the community, and increasingly so in the present emergency.

History

Before outlining the qualifications for admission to an approved School of Anesthesia, and the training necessary to meet the requirements today, it will be of interest to review a little of the early history of the advent of the nurse anesthetist. Miss Alice MaGaw, a graduate from the Woman's Hospital School of Nursing in Chicago in 1889, was appointed as anesthetist to Drs. William J. and Charles H. Mayo in 1892, which position she held until 1908. While Miss MaGaw may not have been the first nurse anesthetist, she was the first to publish a paper on anesthesia, which was entitled "A Review of over 14,000 Surgical Anesthesias." This article was published in *"Surgery, Gynecology and Obstetrics,"* December 1906, pages 795-799, and was reprinted in the May 1939 issue of the Bulletin of the American Association of Nurse Anesthetists. The open drop method of administering ether was emphasized in Miss MaGaw's report of her series of 14,380 anesthesias without a death directly attributed to the anesthetic.

The introduction of the nurse anesthetist was primarily on an experimental basis, but the special aptitude of many nurses for the exacting and serious work of anesthesia soon became apparent, and nurse anesthetists were employed in increasing numbers by many prominent surgeons and hospitals. At the annual conventions of the American Association of Nurse Anesthetists and the American Hospital Association, as well as in state and regional meetings, and in published articles without number, many leading surgeons have expressed their approval and appreciation of the efficient, dependable service rendered by the nurse in anesthesia.

Legal Aspects

From time to time, and especially during the depression, there was more or less agitation in various sections of the country, in regard to the right of the nurse anesthetist to administer anesthetic drugs. A few years ago a test case was tried in

California, and the Supreme Court of that state held that the administration of general anesthetics by licensed and registered nurses employed by hospitals and surgeons in the State of California was not in violation of the Medical Practice Act.

The Court in its opinion stated:

> "We are led further to accept this practice and procedure as established when we consider the evidence of the many surgeons who supported the contention of the defendant nurse and whose qualifications to testify concerning the practice of medicine in this community and elsewhere were established beyond dispute. That such practice is in accord with the generally accepted rule is borne out by the decided cases."

The decision rendered in California is in agreement with the accepted practice in other states and in consequence the nurse anesthetist is free to follow her profession without let or hindrance. There are several thousand nurse anesthetists employed in the United States, which is ample evidence that this service is recognized generally as an approved and essential branch of modern hospital organization.

Service in First World War

During the first World War an illustrious chapter was added to the history of the nurse anesthetist by the brave and generous service of anesthetists in France and other foreign lands. They also contributed much toward the improvement of anesthesia service abroad by teaching

Left to right: George W. Crile, M.D., Sir Berkeley Moynihan, Captain Leonard Braithwaite and Agatha C. Hodgins
—American Ambulance Hospital, Paris, 1915

the use of nitrous oxide. It was due undoubtedly in large measure to the ability displayed by the nurse anesthetists during that period, that the popularity of the nurse as an anesthetist increased so rapidly following the war.

Education of the Nurse Anesthetist

From the beginning the work of training nurses in anesthesia has been carried forward largely by the leaders in the group. To our knowledge the first School of Anesthesia was started in 1911 at the Lakeside Hospital (now the University Hospitals of Cleveland, Ohio). Miss Agatha C. Hodgins was placed in charge under the direction of Dr. George W. Crile, at that time Professor of Surgery, Western Reserve University School of Medicine, and Chief Surgeon at Lakeside Hospital. This institution was one of the pioneers in the development of nitrous oxide as an anesthetic gas.

Today in almost every section of the country there are well organized Schools of Anesthesia, and graduates from such schools are in constant and increasing demand by surgeons and hospitals.

Organization of American Association of Nurse Anesthetists

Following the rapid increase in the number of nurse anesthetists and realizing that no other organization in existence was in a position to understand and solve their peculiar problems, a need was felt by the nurse anesthetists for an organization of their own group.

Pursuant to a call from Miss

Classroom University Hospitals of Cleveland, where organization meeting was held

Hodgins, its founder and first President, the National Association of Nurse Anesthetists (later named the American Association of Nurse Anesthetists), was organized at a meeting held in the anesthesia classroom of the University Hospitals of Cleveland, on June 17, 1931. Officers were elected and constitution and by-laws adopted.

The following were outlined as the principal objectives of the Association:

1. That high standards be developed and maintained in the education of the nurse anesthetist.
2. That the individual nurse anesthetist already in the field be assisted in every way possible in increasing her knowledge and technical skill—
    a. By the arrangement of regular national, state and regional meetings for presentation and discussion of papers on various aspects of anesthesiology, with open conferences on problems affecting the work and status of the nurse anesthetist.
    b. By the publication of a journal devoted to subjects of interest and value to the group, and to which members could contribute their own experiences and also profit by reports of the work of other members.

The founders of the organization were certain that the educational program in prospect would be of great value to the Schools of Anesthesia and to the members of the Association. They were also confident that their concerted efforts to raise the standards of the work would redound to the advantage of the patient, the surgeon and the hospital.

Growth of the Association

At the invitation of the American Hospital Association, the first annual meeting was held in Milwaukee in conjunction with the convention of the hospital organization. The Association has grown rapidly in strength, now numbering over twenty-four hundred members. In a comparatively brief period its prestige and influence have advanced to the point where today many hospitals stipulate as a necessary condition of the employment of the nurse anesthetist that she be a member in good standing of the American Association of Nurse Anesthetists.

National Examination Program

A committee has been appointed to formulate plans for the establishment of national examinations for nurse anesthetists for the purpose of determining the eligibility of applicants for membership in the American Association of Nurse Anesthetists. This is particularly necessary for those anesthetists who have had extensive experience in administering anesthetics but who have not been graduated from an approved School of Anesthesia. It is hoped that this committee will be prepared to give a detailed report at the annual meeting in September, 1942, and that the examination program may be in operation early in 1943.

State Associations

The national headquarters of the Association was moved from Cleveland to Chicago in October, 1937, and this forward step gave great impetus to the state organization work. At the present time there are members of the Association in every state of the Union, in England, Canada, Alaska, Panama and the Canal Zone, the West Indies, South America, Hawaii, China and India. The state associations hold district, state and regional meetings annually, or as often as prac-

ticable, in connection with the convention of the state hospital organization. The state associations are affiliated organically with the American Association of Nurse Anesthetists and send delegates to the annual meetings of the American Association held regularly in conjunction with the American Hospital Association. Among the largest state associations are Pennsylvania, with 237 members; Illinois, 214 members; New York, 161 members; Ohio, 97 members.

The Bulletin of the American Association of Nurse Anesthetists

The first issue of the Bulletin, the official organ of the Association, was published in 1933. In it are published announcements, programs and reports of meetings held in all sections of the country.

Papers read by nurse anesthetists, surgeons and medical men at various meetings, and contributed articles as well, are published in the Bulletin. This bulletin has a Department of Education as a separate section, which includes information in regard to modern approved techniques for the administration of the various anesthetic drugs and gases, and articles by authorities on pharmacology, physiology and other branches of medical science bearing on anesthesiology. This Department is intended primarily as a source of teaching material for Schools of Anesthesia.

The subscription list includes a growing number of prominent medical men and surgeons, hospital superintendents, et cetera. The Bulletin is highly prized by the members, many of whom preserve the issues in permanent bound form for reference. So many calls have come into headquarters for copies of back issues, that at present only a few copies of the earlier numbers are available. The popularity of the Bulletin demonstrates forcefully the fact that the capable anesthetist keeps alive her progressiveness by following a program of reading and study that continually expands her knowledge and increases her efficiency.

The subscription price is included in the annual dues for membership in the Association. The price to nonmembers is One Dollar per year, single copies 50 cents. The Bulletin is published quarterly with business offices at 2065 Adelbert Road, Cleveland, Ohio.

Educational Program

The major activities of the Association are concerned with the educational program of the organization. Specific projects connected with the carrying out of this program are under the general direction of the Educational Committee.

A revised recommended curriculum was adopted at the annual meeting held in Cleveland, Ohio, in September 1936, and published in the May 1937 issue of the Bulletin, pages 301-310 inclusive. Following the report of the Curriculum Committee in September 1940, some additions and revisions were made in the advocated curriculum in keeping with current progress in the field and in the more advanced schools.

In 1941, a project was launched to survey the existing Schools of Anesthesia and to evaluate each of them in regard to their conformity or lack of conformity to the standards set up by the Association as outlined in the recommended curriculum and plan of organization for recognized Schools of Anesthesia. It is expected that the Educational Committee will have analyzed the results of the survey and will be in a position to make a report at the annual meeting of the Association in October, 1942, to be held in St. Louis.

Organization Plan Recommended for Schools of Anesthesia

The recommended plan of organization for Schools of Anesthesia may be summarized briefly as follows:

1. *Type of institution desirable for a School of Anesthesia:*
   a. A hospital having an active surgical division, embracing all types of surgical cases.
   b. Expert anesthetists on teaching staff, who are qualified instructors and interested in teaching.
   c. Proper equipment and facilities for teaching anesthesia — modern gas machines and other apparatus in general use.
   d. Preferably institutions with University affiliation, resulting in broadened practical and theoretical training.
2. *Duration of course:*
   Six months' duration the minimum; eight months or one year strongly recommended.
3. *Size of student body:*
   Strictly limited to the number which by reason of the activity of the surgical service is able to obtain, during the duration of the course, the required number and types of cases as recommended by the American Association of Nurse Anesthetists.
4. *Time off duty:*
   An average of not more than eight hours on duty daily is advocated, in order that the student may remain mentally and physically capable of good work. Rest periods are recommended between the work in the clinic and the class hours, with extra time off following night duty.
5. *Field trips* to other hospitals and to plants manufacturing anesthetic gases and drugs are desirable.
6. *Class room instruction* covers the following subjects:
   - History of anesthesia
   - Psychology in anesthesia
   - Premedication
   - Preoperative and postoperative care
   - Mechanical manipulation of various anesthetizing machines and accessories
   - Positions for various operations
   - Signs of anesthesia
   - Anesthetic drugs and gases in common use—
     Ether, vinethene, nitrous oxide, cyclopropane, ethyl chloride, ethylene, chloroform, avertin, intravenous anesthetics (including evipal and sodium pentothal); spinal and local anesthetics, et cetera.
     a. Simple chemistry and physical characteristics
     b. Pharmacological effects upon the body
     c. Specific objective symptoms
     d. Methods of administration
     e. Indications and contraindications
     f. Resuscitative measures
     g. Fire hazard; explosive concentrations; precautions.
   - Anatomy and physiology of respiration and circulation
   - Surgical shock
   - Oxygen therapy
   - Carbon dioxide
   - Helium

The order of teaching subjects in each institution varies with the anesthetics in major use in that clinic.

Textbooks and reference works are usually available in the school library.

A diploma or certificate is awarded at the completion of the course in anesthesia.

Requirements for Admission to Schools of Anesthesia

The requirements for admission to approved Schools of Anesthesia at present are as follows:

1. *Education:*
   a. Four years of high school; college entrance credits advocated.
   b. Only graduates of accredited Schools of Nursing, who have passed required State Board examinations, are accepted.
2. *Age:*
   a. Minimum 24 years; maximum age limit 35 years. Applicants under 24 may be accepted subject to excellent recommendations as to maturity of judgment and acceptance of responsibility.
   b. While exceptions may develop as to upper age limit, experience has shown the undesirability of admitting students beyond the age of 35.
3. *Experience:*
   From one to two years experience in general nursing is highly desirable as a background.
4. *References:*
   a. References are usually required from the Superintendent of the Training School for Nurses from which the applicant was graduated, including a transcript of grades.
   b. References are also obtained from two physicians with whom the applicant has been associated, and who are acquainted with her physical condition and probable aptitude for the work.
   c. A snapshot or photograph of the applicant is required.
5. *Health:*
   Each student before actually beginning the course in anesthesia should be given a physical examination by a member of the hospital staff, including specifically an x-ray of the chest.

In general, the requirements for admission to an approved School of Anesthesia would cover good general health and endurance; intellectual capacity above average; personality—well balanced, tactful and cooperative, with good poise and judgment in emergencies; through conscientiousness and ability in carrying out detailed procedures, with mind and hand well coordinated.

Present Need for Nurse Anesthetists Is Urgent

The need for nurse anesthetists both in civilian and Army hospitals is becoming increasingly urgent. In order to meet the situation, many Schools of Anesthesia have increased the student body. The degree of expansion is limited, however, because in order to qualify for membership in the American Association of Nurse Anesthetists, each anesthetist must have administered a certain number of anesthetics during her training. The American Association has been opposed to lowering the standards by allowing the student to be graduated with less clinical experience than necessary to prepare her properly for work in active surgical clinics. The Association has therefore encouraged the establishment of schools in hospitals equipped to offer training in this field.

Opportunities in Anesthesia

The conditions of employment and remuneration compare favorably with those in supervisory and teaching po-

sitions in other branches of nursing. There has been a general expansion of hospital service during the last few years with consequent enlargement of anesthesia staffs in many institutions. Opportunities for advancement are presenting themselves in all large centers. In addition to openings for nurse anesthetists in hospitals, attractive positions are frequently available in the offices of surgeons and dentists in private practice. At the present time many more calls for nurse anesthetists are being received by the Schools of Anesthesia than they can fill.

NOTES FROM HEADQUARTERS

MARY ELIZABETH APPEL
Executive Secretary

CONVENTION

Barring the vicissitudes of war, the convention this fall in St. Louis, Missouri, will carry one of the timeliest programs in the history of the association. You cannot afford to miss hearing a prominent surgeon discuss the "defense anesthetist." The speaker-to-be is in constant touch with war activities in the medical field in the nation's capital and will bring to you the latest information available in regard to the status of the nurse anesthetist—her job and her future in the defense program. Right now all of you are concerned with war-born problems. Come to the convention and learn the latest developments in your association's activities and talk over your own problems with fellow members.

The medical superintendent of one of the nation's leading hospitals will discuss war-time purchasing of anesthetic supplies.

Quizzes and Experts

There will be well-planned panel discussions with experts pitted against the general membership on subjects of primary interest to every nurse anesthetist. Some vital topics under discussion will be, "how to meet the shortage of nurse anesthetists," "duties of the army nurse," and "post-war adjustments."

You may rest assured that there will be nothing cut and dried at the coming convention. Your active participation will make it a better and bigger meeting.

Where and When

St. Louis, Missouri, is the city, the Statler Hotel is the place, and the dates are October 12-15, 1942.

Your Reservation, Please!

Hotel space will be at a premium, so please send your reservation to the hotel now, along with your reservation for the banquet. This will help the Local Arrangements Committee in its selection of rooms and will be appreciated by the hotel management.

Headquarters hotel in St. Louis

HOTEL STATLER

Each room has private bath. Prices range from $2.75 to $5.00 for single rooms; $4.50 to $7.00 for room with double bed; $5.00 to $9.00 for room with twin beds; three persons in room $7.00 to $9.00.

PIN POINTERS

Enthusiastic comments from the membership in general greeted the arrival of the new official emblem of the American Association of Nurse Anesthetists. One member said she had had eight pins since she entered nurses' training, but that this one was the loveliest of all. Many members have written notes of appreciation to the association, and to the Seal Committee in particular, for its fine work in producing this beautiful and distinctive pin.

You will not want to be without this insignia of your organization. Because of the stress and uncertainty connected with manufacturing problems, those of you who desire a pin should send in your order as promptly as possible, as it may take from four to five weeks for delivery.

Any engraving that you may wish can be taken care of by your own jeweler.

Please make check or money order payable to the American Association of Nurse Anesthetists in the amount of $4.00 and send with your order to headquarters.

POSITIONS HUNT NURSE ANESTHETISTS

Telegrams and urgent letters continue to arrive at headquarters from hospitals in all parts of the country asking for the services of a nurse anesthetist. In an effort to meet this problem, the Association, through the Committee on Education, is giving the utmost cooperation to the hospitals in the

process of organizing schools of anesthesia. With the hope of obtaining a standardization of organizational procedure for schools, the Committee sends out, in addition to the curriculum, a complete set of model record forms with an explanatory memorandum for each.

ONE HUNDREDTH BIRTHDAY OF ANESTHESIA

Sister Rudolpha, Director of Anesthesia, St. John's Hospital, Springfield, Illinois, looked out calmly from a page of the Illinois State Register of Springfield on March 29, 1942. This newspaper carried nearly a full page story under the heading—"Mankind's search for the conquest of pain will pass another milestone March 30, the one hundredth anniversary of the first operation performed under an anesthetic." As a fitting contrast to the torture-filled operations of an earlier day, this article showed Sister Rudolpha with one of her staff assistants and the supervisor of surgery in the operating room ready for the doctor's entrance. The gas machine was shown at the left of the nurse anesthetist, with the patient under the influence of the anesthetic.

This modern operating-room scene with its trained nurse anesthetists was directly opposite a picture of an operation which took place on October 16, 1846, and which according to the Illinois State Register was "probably the first public demonstration of operation under ether."

CAREER BROCHURE

To meet the demand from student and graduate nurses for information on anesthesia as a career, the Association has prepared a brochure on this subject. It is published in this issue of the Bulletin and will be available at Headquarters in pamphlet form.

HEADQUARTERS LIBRARY

Maude C. Fleming of Louisburg, North Carolina, has generously donated her private collection of books and journals on anesthesia to the Headquarters Library. The anesthesia magazines, with marked articles for reference, were sent with the thought of starting a package library service.

WASHINGTON ASSOCIATION JOINS A. H. A.

Heading the list as the first state association of nurse anesthetists to join the American Hospital Association is the Washington group. Their certificate of membership was mailed to them by the American Hospital Association on March 17, 1942. This automatically gives them full membership status in the Washington State Hospital Association as well as in the American Hospital Association.

DEFENSE ACTIVITIES

Dipping into the treasury to the extent of $500 for a Defense Bond is one of the Illinois Association's ways of helping our country on the home front. To our knowledge Illinois is the first state organization to donate $100 to the American Red Cross.

Right in line in buying bonds are the following state Associations:

Texas, $150, Pennsylvania, $200, and California (amount to be announced later).

ADVANCEMENT FOR A NURSE ANESTHETIST

The first nurse anesthetist to act as Supervisor of Anesthesia for all the state hospitals in Illinois is Miss Mabel Nichol, former President of the Illinois Association of Nurse Anesthetists. There are fourteen state hospitals and Miss Nichol's duties include a visit to each institution for the purpose of bringing its Anesthesia Department up to date in so far as equipment, records, approved technique and instruction in the administration of anesthesia are concerned.

It is Miss Nichol's hope to have a trained nurse anesthetist in each of these hospitals eventually.

FORWARD MARCH IN MEMBERSHIP

Your membership roster has been steadily forging ahead and at the end of March, 1942, almost reached the 2500 mark. Stimulated by the great need for nurse anesthetists all over the country, many members who had been inactive for many years due to marriage have re-applied for active membership and have come back into service. Also, several members who held associate membership status have resumed active duty and have been accepted for active membership.

NEWS NEEDED

Headquarters is missing out on the news! Couldn't you write in just a bit in regard to who did what, and where? The state associations and the membership at large must be involved in interesting activities of significance to all, and these pages could come to life with bits of news from everywhere.

ACTIVITIES OF STATE ASSOCIATIONS

GEORGIA

Meetings held at Georgian Terrace Hotel, Atlanta, second Thursday of each month except during summer, afforded stimulating contacts and valuable information. Programs included the following guest speakers:

Dr. Frank Boland	"History of Anesthesia"
Dr. Park McGinty	"Anesthesia and Sulfanilamide Derivatives"
Dr. Thomas Conner	"Anesthesia in Dental Surgery"
Dr. Charles Mitchell	"Interval Spinal Anesthesia"
Dr. Champ Holmes	"Anesthesia in Tuberculosis"
Mrs. Martin	"Red Cross and Home Defense"

It is planned to continue meetings, and hoped that more out-of-town members will attend.

REPORT OF SECRETARY-TREASURER:

Members in good standing		44
Delinquent members		3
New members	7	
Members transferred to Georgia Ass'n.	2	
Members transferred from Georgia Ass'n.	4	
Applications pending	1	
Cash on hand April 15, 1941		$ 169.93
Receipts		
Dues	$ 285.00	
Initiation fees	16.00	
Receipts from turkey raffle (held in November)	70.17	
Donations	9.00	
Interest earned on savings account	1.15	381.32
		$ 551.25
Disbursements		
Dues to American Ass'n.	$ 189.75	
Initiation fees to American Ass'n.	16.00	
Fees to Southeastern Ass'n of Nurse Anesthetists: ($1 for each active member, 62c for each associate member	42.62	
Donation to delegate to 1941 meeting in New Orleans	5.00	
President's expenses to Atlantic City convention	75.00	
Office expenses	24.72	$ 353.09
Cash on hand		$ 198.16

CLARA MAHONEY,
Secretary-Treasurer.

The fifth annual meeting of the Georgia Association of Nurse Anesthetists was held in Memphis, February 10, 1942, in conjunction with Southeastern Association of Nurse Anesthetists.

Officers elected:

President	Jean Greear McGinty Elbert County Hospital, Elberton
Vice-President	Mildred Davis Ponce de Leon Eye, Ear, Nose and Throat Infirmary, Atlanta
Secretary-Treasurer	Clara C. Mahoney Crawford W. Long Mem'l Hospital, Atlanta
Trustees	Rosalie C. McDonald Billie B. Caraway Delores A. Sparks

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PROGRAM

Anesthetists of Illinois, Indiana, Michigan and Wisconsin

JOINT MEETING

Held in conjunction with the Tri-State Hospital Assembly

South Ball Room, Third Floor
Stevens Hotel, Chicago

May 6-8, 1942

Mae B. Cameron
Chairman

Wednesday, May 6

12:30 P.M. BUSINESS SESSION AND LUNCHEON
Indiana Ass'n of Nurse Anesthetists—Stevens Hotel

GENERAL SESSION

2:00 P. M. Call to Order
Mae B. Cameron, Chairman, Assembly of Nurse Anesthetists of the Illinois, Indiana, Michigan and Wisconsin Associations, Chief Anesthetist, Ravenswood Hospital, Chicago
Ruth H. Hane, Presiding
President Indiana Association of Nurse Anesthetists, Fort Wayne
Greetings from Tri-State Hospital Assembly
Malcolm T. MacEachern, M. D., Chicago
Associate Director, American College of Surgeons
Chairman, Program Committee, Tri-State Hospital Assembly
Greetings from American Association of Nurse Anesthetists
Mary E. Appel, Chicago, Executive Secretary
"Management of Hazardous Operations"
Walter Maddock, M. D.
Associate Professor of Surgery, University Hospital, Ann Arbor, Mich.

"The Administration of Sodium Pentothal"
Seymour Shotz, M. D.
Director of Anesthesia, Mt. Sinai Hospital Chicago
"Postoperative Thoracic Complications" (with slides)
Cameron Haught, M. D.
Professor of Surgery, University Hospital, Ann Arbor
"Premedication"
Esther E. Edwards, President Wisconsin Association of Nurse Anesthetists; Chief Anesthetist, Wausau Memorial Hospital, Wausau, Wis.

Thursday, May 7

1:00 P. M. Joint Luncheon Meeting Illinois, Indiana, Michigan and Wisconsin Associations

Anna Willenborg, Presiding
Director, School of Anesthesia, Mercy Hospital, Chicago
"The Army Nurse Corps; Nurse Anesthetists in National Defense"
Captain Ida W. Danielson, Assistant Superintendent Army Nurse Corps, Washington, D. C.

PLEDGE OF ALLEGIANCE TO THE FLAG:

"I pledge allegiance to the flag of the United States of America, and to the Republic for which it stands, one Nation indivisible, with Liberty and Justice for All."

BUSINESS MEETING OF THE TRI-STATE NURSE ANESTHETIST ASSEMBLY

BUSINESS SESSIONS

Illinois Association of Nurse Anesthetists
South Ball Room, Third Floor
Michigan Association of Nurse Anesthetists
Private Dining Room, Third Floor
Wisconsin Association of Nurse Anesthetists
Private Dining Room, Third Floor

Friday, May 8

GENERAL SESSION

2:00 P. M. Nelle G. Vincent, Presiding
Evanston Hospital, Evanston, Ill.
"Cause of Operative Deaths"
Josiah J. Moore, M. D.
Pathologist, Ravenswood Hospital, Chicago
"Anesthesia for Infants in Oral and Plastic Surgery"
Louis W. Schultz, M. D.
Presbyterian Hospital, Chicago
"Intratracheal Anesthesia" (with slides)
Lillian G. Baird,
University Hospital, Ann Arbor, Mich.
"Experiences in Anesthesia"
A. Maude Galbraith,
Butterworth Hospital, Grand Rapids, Mich.

LOUISIANA

Annual meeting held at Jung Hotel, New Orleans, March 23, 1942, twenty-three present. At morning session following papers were read:

"Spinal Anesthesia"
Dr. John Adriani, Director Department of Anesthesia, Charity Hospital, New Orleans

"The Choice of Anesthesia"
Dr. L. H. Wright, E. R. Squibb & Co., New York City

Officers elected:

President	O. Rowene Kling Ochsner Clinic, New Orleans
First Vice-President	Rosalie G. Sullivan Hotel Dieu, New Orleans
Second Vice-President	Elizabeth Nock Charity Hospital, New Orleans
Secretary	Viola R. Dodd Hotel Dieu, New Orleans
Treasurer	Mattie T. Word 1410 St. Andrew St., New Orleans
Historian	Mrs. Sam Owen State Charity Hospital, Shreveport
Trustee	Mary E. Koenig

MID-SOUTH POST GRADUATE NURSE ANESTHETISTS ASSEMBLY

Eighth annual meeting was held in Memphis, February 11-12, 1942, thirty-six members and guests in attendance (program published in full in February, 1942 issue of Bulletin).

Officers elected:

President
Nettie M. Bryant
1634 Euclid Avenue, Memphis, Tenn.

First Vice-President
Inez R. Rausch
University of Arkansas Hospital, Little Rock

Second Vice-President
Irene H. Ford,
Grenada General Hospital, Grenada, Miss.

Secretary-Treasurer
Alberta K. Sullivan
48 S. Diana St., Memphis, Tenn.

Nettie M. Bryant
President

MICHIGAN

February meeting held on 21st at Nurses' Home, St. Joseph Hospital, Detroit, with fifty in attendance.

Dr. Edward Cathcart spoke on "Choice of Anesthesia in Urological Surgery," and Dr. Myra Babcock, of Grace Hospital, Detroit, on "Modifications in Anesthesia Technique." An interesting informal discussion followed.

Refreshments were served by anesthetists at St. Joseph's Hospital.

MINNESOTA

Twenty-eight anesthetists attended meeting at Midway Hospital, St. Paul, on January 27. Dr. Harry Hall of University Hospital gave an interesting talk on his recent experiences in England.

Committee reports were presented. Alpha Boyer of Midway Hospital was appointed to fill vacancy on Board left by the resignation of Grethe Westly. Association voted to pay 1942 dues of President, Secretary and Treasurer of the Minnesota Association. It was decided to ask all members to contribute extra dollar to help defray expenses for state meeting and for delegates to American Association convention.

February meeting held on 24th at St. Barnabas Hospital Nurses' Home, Minneapolis, twenty-eight in attendance. Miss Kling, a teacher who had spent seven years in Alaska, spoke on her experiences.

At meeting March 31 at St. Joseph's Hospital, St. Paul, following the business session the Canadian National Railway presented sound pictures in color, of Jasper National Park.

A group of Minnesota anesthetists have arranged to take part in a radio program "Quiz of the Twin Cities," donating money received (an expected $40) to Minnesota Association to help finance delegates to annual meeting. Listen in on Monday, May 18, at 6:30 P.M. on WCCO.

Continuation course in anesthesiology held March 26-28 at University of Minnesota was most successful, with over ninety nurse anesthetists registered. Anesthetists attended from Montana, Arkansas, North and South Dakota, Wisconsin and Iowa in addition to Minnesota group.

The Faculty:

Ralph T. Knight, M. D., Medical School, University of Minnesota

John L. Lundy, M. D., Mayo Foundation, Rochester

Mary Karp, M. D., Clinical Assistant in Surgery, Northwestern University Medical School, and Chief Anesthetist Wesley Memorial Hospital, Chicago

John Grimm, M. D., Medical Fellow in Anesthesiology, University of Minnesota

Lloyd H. Mousel, M. D., Instructor in Anesthesia, Mayo Foundation, Rochester

William A. O'Brien, M. D., Director, Postgraduate Medical Education, University of Minnesota

Palma Anderson, Deaconess Hospital, Minneapolis

Certificates were presented by Mr. J. M. Nolte, Director, Center for Continuation Study, University of Minnesota.

TREASURER'S REPORT

Cash on hand November 1, 1941		$ 191.91
Receipts		
Dues	$ 120.00	
Cash refunded by Hazel Peterson and Palma Anderson	30.00	150.00
		$ 341.91
Disbursements		
National dues	$ 46.00	
Convention expenses for Mary Janovich	30.00	
Flowers for Grethe Westly; stamps and miscellaneous	8.50	84.50
Cash on hand February 1, 1942		$ 257.41

ELIZABETH L. GAERTNER,
Treasurer.

PROGRAM—EIGHTH ANNUAL CONVENTION
MINNESOTA ASSOCIATION OF NURSE ANESTHETISTS

Rochester, Minnesota

Monday, May 25, 1942

8:30 A. M. Registration (no fee)

9:30 Joint meeting with Minnesota Hospital Association
"The Anesthetist"
Dr. L. H. Wright, E. R. Squibb & Sons, New York

12:15 P. M. Luncheon with Minnesota Hospital Association and allied groups

2:00 Business meeting (members only admitted)
Palma Anderson, President, presiding

GENERAL SESSION

2:30 Greetings
Miss Esther Wolfe, St. Andrew's Hospital, Minneapolis, President Minnesota Hospital Association

Address of Welcome
C. W. Mayo, M. D., Mayo Clinic, Rochester

2:45 "Choice of Anesthetic Agents"
Dr. L. H. Wright, E. R. Squibb & Sons, New York City

3:30 "Intratracheal Anesthesia"
R. C. Adams, M. D., Section on Anesthesia, Mayo Clinic, Rochester

6:30 Banquet — Minnesota Hospital Association and Allied Groups

For further information write Hazel J. Peterson, Fairview Hospital, Minneapolis.

NEW JERSEY

Third annual meeting New Jersey Association of Nurse Anesthetists, Berkeley-Carteret Hotel, Asbury Park, May 20, 1942, 2:00 P. M.; banquet 7:30 P. M.

For further information write Frances M. Waters, Secretary, Cooper Hospital, Camden, N. J.

NEW YORK

PROGRAM

ANNUAL MEETING

NEW YORK STATE ASSOCIATION OF NURSE ANESTHETISTS

Held in conjunction with New York State Hospital Association

Sessions in Buffalo—May 21, 1942
Sessions in Rochester—May 22, 1942
Buffalo Headquarters—Hotel Statler

Thursday, May 21

8:00 A.M. Clinic—Buffalo General Hospital

10:00 GENERAL SESSION

Buffalo General Hospital

Marie P. Dobbie, Buffalo, Presiding

"Sodium Pentothal Anesthesia"
Paul W. Searles, M.D., Buffalo General Hospital

"Neurosurgical Anesthesia"
Clarence Durshordwe, M.D., F.I.C.S., Buffalo Gen'l Hospital

12:30 P.M. Luncheon—Guests of Buffalo General Hospital

2:30 P.M. BUSINESS MEETING

Frances B. Hess, President, Presiding

Talks on National Association Affairs
by Helen Lamb, President
and other National Officers and Committee Chairmen

Informal Round Table
Marie Stroobant, Rochester, Presiding

7:00 P.M. Banquet — Hotel Statler

Friday, May 22

9:00 A.M. Clinic—Strong Memorial Hospital, Rochester

12:30 P.M. Luncheon—Guests of Strong Memorial Hospital

2:15 GENERAL SESSION

Strong Memorial Hospital Amphitheater

Hazel Blanchard, Troy, N. Y., Presiding

"Surgery of the Heart"
Claude S. Beck, M.D., Professor of Neurosurgery,
Western Reserve University, Cleveland, Ohio

"Prevention and Treatment of Shock in the Operative Patient"
Earle B. Mahoney, M.D.
Instructor in Surgery, University of Rochester
School of Medicine

"Some New Ideas on Venous Thrombosis and Pulmonary Embolism
Hrolfe Ziegler, M.D.
Instructor in Surgery and Anatomy,
University of Rochester School of Medicine

"Preliminary Report on Bronchoscopy and Suction in Relation to Postoperative Pulmonary Complications"
Virginia M. Foley
Strong Memorial Hospital, Rochester

For further information write Miriam G. Shupp, Strong Memorial Hospital, Rochester, N. Y., or Alice M. Racette, Ellis Hospital, Schenectady, N. Y.

PENNSYLVANIA

Eleventh annual meeting Pennsylvania Association of Nurse Anesthetists was held at Hotel William Penn, Pittsburgh, April 15 and 16, 1942.

Recommendation of Revisions Committee was approved that changes be made in by-laws to conform with by-laws of the American Association of Nurse Anesthetists.

It was voted to appropriate $200 for purchase of United States War Bonds. It was decided to allot 25¢ of each member's dues to District Associations. It was felt that this financial aid would stimulate the work of these small organizations and assure their continuance.

Papers in contest for student anesthetists in Pennsylvania had been judged by the Educational Committee of the American Association of Nurse Anesthetists, and awards were announced.

Prizes	*Name of Contestant*	*School of Anesthesia*	*Title of Paper*
*First prize—$10	Gladys Camerer	Jewish Hospital,	"Mortality in Ether Anesthesia"
*Second prize—$5	Martha Dennis	Philadelphia ditto	"The Use of Bulk Ether"

Officers Elected:

First Vice-President	Leola M. Richter Presbyterian Hospital, Pittsburgh
Secretary-Treasurer	Helen Young Walker 1824 Wallace Street, Philadelphia

* First prize donated by Edith Davis.
Second prize donated by Pennsylvania Association.

Historian	Ida McK Emerick Rochester General Hospital, Rochester
Trustees, 1942-1944:	Mary E. Jarvis Elizabeth J. Millard Mathilda M. Margison

Mary Roenbaugh, West Pennsylvania Hospital, Pittsburgh, presided at afternoon session. Following invocation by the Rev. Edwin L. Koutz, Baptist Church, Pittsburgh, greetings were extended by Edith Davis, Allentown Hospital, Allentown, President of Pennsylvania Association of Nurse Anesthetists, and by Helen Lamb, Barnes Hospital, St. Louis, President of American Association of Nurse Anesthetists. The following papers were read:

"Choice of Anesthesia in Gynecological Surgery"
J. S. Silvis, M.D., F.A.C.S.
Allegheny General Hospital, Pittsburgh

"Anesthesia in Obstetrics"
C. J. Barone, M.D., F.A.C.S.
Elizabeth Steele Magee Hospital, Pittsburgh

"Anesthesia in Ophthalmology"
Paul F. Holl, M.D.
Eye and Ear Hospital and West Pennsylvania Hospital, Pittsburgh

Paper by Adelinda A. Vogel, St. Francis Hospital, Pittsburgh
"Helium in Anesthesia"
Clare B. Lucas, Allegheny General Hospital, Pittsburgh

On Thursday morning, April 16, clinic was held at Allegheny General Hospital, followed by a talk by James C. Burt, M.D., F.A.C.S., Chief of the Surgical Staff. Luncheon was served at the hospital.

At afternoon session Eileen Clancey of Mt. Lebanon presided. Greetings were extended by Mr. William E. Barron, Superintendent Washington Hospital, Washington, Pa., President Hospital Association of Pennsylvania. The following subjects were presented:

"The Surgeon Looks at the Anesthetic Record"
Philip A. Faix, M.D.
Director of Anesthesia, Mercy Hospital, Pittsburgh

Round table—"Evaluation of the Anesthetic Risk and the Preoperative Management of Anesthetic Cases"

Chairman—Robert L. Patterson, M.D.
Director of Anesthesia, Allegheny General Hospital

Collaborators—George J. Thomas, M.D.
St. Francis Hospital
Professor of Anesthesia, University of Pittsburgh

Philip A. Faix, M.D.
Director of Anesthesia, Mercy Hospital, Pittsburgh

Report of Treasurer

Cash in Bank April 1, 1941		$1584.00
Receipts		
Dues	$1725.00	
Initiation fees	72.00	
Donation for prize in students' contest (from Edith Davis)	10.00	
Dues from American Ass'n for members transferred into state	3.00	
Dues overpaid by members	3.00	1813.00
		$3397.00
Disbursements		
Remittances to American Ass'n:		
Dues	$1157.75	
Initiation fees	72.00	
Prizes awarded in students' contest	15.00	
Office expenses	84.71	
Bond, Fidelity Ins. Co., for Sec'y-Treas.	5.00	
Convention expenses	213.98	
Donation to Educational Committee American Ass'n	100.00	
Pin refund	1.00	
Dues refunded	6.50	1655.94
Cash in Bank March 31, 1942		$1741.06
Represented by:		
Deposits at: Central Penn Nat'l Bank	$ 741.06	
Philadelphia Sav'g Fund Soc'y	1000.00	$1741.06

HELEN YOUNG WALKER,
Secretary-Treasurer

Report of Secretary

Members in good standing April 1, 1941	227
Members in good standing April 1, 1942	247
Delinquent members:	
April 1, 1941	54
April 1, 1942	52
Dropped (dues unpaid for two years)	8
Resignations	1
Address unknown	4
Members transferred to Pennsylvania Ass'n	9
Members transferred from Pennsylvania Association	16
New members	34
New members accepted (March 15 to April 15, 1942—dues unpaid as of April 15)	8
Applications pending approval by American Association	3

Total membership April 1, 1941 281
Total membership April 1, 1942 299
Correspondence sent out (letters, bills, notices, membership cards) ..... 1377 pieces
Correspondence received (as above) ..... 631 pieces

OREGON

December meeting held at Good Samaritan Hospital, Portland, followed by a Christmas party presided over by Santa Claus (Rose Hanson).

January meeting St. Vincent's Hospital, Portland. Miss Vreeland and Miss Kidwell, who had attended a school conducted by the Chemical Warfare Division of the Army, gave an interesting and instructive lecture on damage from high explosive and incendiary bombs, methods of decontamination in gas warfare, detailed black-out procedures, et cetera. All anesthetists were urged to take a course in first aid.

On March 16 anesthetists met at Doernbecher Memorial Hospital for Children, Portland. It was voted to join the Oregon Hospital Association rather than the Western Hospital Association in order to avoid longer trips during this emergency.

Oregon anesthetists were invited to attend annual meeting of the Washington State Association of Nurse Anesthetists in Seattle, April 17-18. Miss Aura Hakala, student anesthetist under Dr. Hutton at the University of Oregon Medical School, presented a paper on cyclopropane anesthesia.

SOUTHEASTERN ASSOCIATION OF NURSE ANESTHETISTS

Fourth annual meeting held April 9-11, 1942, in Memphis, in conjunction with Southeastern Hospital Conference. Prize of leather portfolio won by Alabama Association for having highest percentage of attendance among the five member states. Helen Lamb, President American Association of Nurse Anesthetists, was a guest.

Morning session April 9 called to order by Esther C. Myers, President. Ruth Hawne, President Tennessee Association of Nurse Anesthetists, gave address of welcome, followed by greetings by Mr. R. G. Ramsey, President Tennessee Hospital Association, and Mr. T. H. Haynes, President Southeastern Hospital Association, with response by Irene Boyles, Baptist Hospital, Birmingham.

Caroline Hohenschutz, President Georgia Association of Nurse Anesthetists, presided at the afternoon session; Elizabeth N. Wates, President Mississippi Association, at the Friday morning session, and Alpha Schier, President Florida Association, at the afternoon session on Friday.

The following program covered a well balanced variety of subjects:

"The Nurse Anesthetists and the War"
Mr. James Hamilton, New Haven, Conn.
President-elect American Hospital Association

"The Value of Oxygenation during Anesthesia"
Mary H. Snively, Duke University Hospital, Durham, N. C.

Symposium:
"Care of the Obstetrical Patient and the New Born;
The Nursing Care during Analgesia"
Ruth Neill Murray, Supervisor Obstetrical Department, John Gaston Hospital, Memphis

"Paraldehyde"
Rosalie C. McDonald, Emory University Hospital, Atlanta
Vice-President American Association of Nurse Anesthetists
"The Management of Obstetrical Anesthesia and Postanesthetic Care"
Arline Johnson, Methodist Hospital, Memphis
"Indications, Contraindications and Dosage of Various Kinds of Analgesia and Anesthesia"
Michael M. Roach, M.D., Memphis
"Atelectasis, Asphyxia, and Resuscitation of the New Born"
W. W. Walker, M.D., Memphis
Summarization by W. T. Pride, M.D., Memphis

"The Choice of Intravenous Anesthesia in Traumatic Surgery"
Hugh Smith, M.D., Willis C. Campbell Orthopedic Clinic, Memphis
"Anesthesia in Laryngeal Surgery"
Rowena Kling, New Orleans, President Louisiana Association of Nurse Anesthetists
"Interpretation of the Seal of the American Association of Nurse Anesthetists"
Jean Greear McGinty, Elbert County Hospital, Elberton, Ga.

Round Table Conference:
Coordinator—Dr. Lewis H. Wright, E. R. Squibb & Sons, New York
"Cyclopropane"
Dr. A. P. Richardson, Professor of Pharmacology, University of Tennessee, School of Medicine, Memphis
"Cardiology"
Dr. Samuel Blackwell, Memphis
"Intravenous Anesthesia"
Dr. George R. Hazel, Assistant Director, Department of Medical Research, Abbott Laboratories, Chicago
"Endotracheal Anesthesia"
Mrs. Turley Farrar, St. Joseph Hospital, Memphis
"Anesthesia in Thoracic Surgery"
Mary Ellen McHugh, Baptist Memorial Hospital, Memphis
"Serial Spinal Anesthesia"
Mae Stroud, St. Vincent's Hospital, Jacksonville, Fla.
"Anesthesia in Neurosurgery"
R. Eustace Semmes, M.D., Memphis
"The Choice of Anesthetic Agent"
Rubye Ridley, Steiner Clinic, Atlanta
"Explosion Hazards"
Hattie Barnes, South Highland Infirmary, Birmingham
President Alabama Association of Nurse Anesthetists

Following clinics held on Saturday morning, April 11:
Endotracheal Anesthesia
John Gaston Hospital
Jacqueline Kooyman, Chief Anesthetist

Cyclopropane Anesthesia; Ethylene Anesthesia

Baptist Memorial Hospital
Mary Ellen McHugh, Chief Anesthetist

Methodist Hospital
Alice Little, Chief Anesthetist

Pentothal Sodium-Oxygen Anesthesia

St. Joseph Hospital
Ann Beddow, Chief Anesthetist

The Tennessee Association gave a luncheon on Thursday at the Peabody Hotel for the Southeastern Association of Nurse Anesthetists. It afforded a much appreciated opportunity for all the state groups to become better acquainted. Dutch lunch "Chicken in the Rough" was served at Hotel Claridge on Friday. Southeastern Hospital Association banquet was held Friday evening.

Officers elected:

President	Rubye Ridley Steiner Clinic, Atlanta, Ga.
Vice-President	Irene Boyles West End Baptist Hospital, Birmingham, Ala.
Secretary-Treasurer	Ida Tedford Ellis 1210 Kuhl Avenue, Orlando, Fla.
Trustees	
Alabama	Hattie M. Barnes
Florida	Alpha Schier
Georgia	Jean Greear McGinty
Louisiana	Rowena Kling
Mississippi	Elizabeth N. Wates

TEXAS

Annual meeting of Texas anesthetists held in Houston, February 27, 1942 (program published in full in February issue). Attendance was much better than anticipated under present conditions.

Voted to invest $150 in Defense Bonds. The Association also has reserve fund of $150 in savings account.

Officers elected:

President	Minnie V. Haas 1121 E. Mulkey, Fort Worth
Vice-President	Jean Vetesk Wright Box 964, Amarillo
Secretary-Treasurer	Mrs. Jack K. Childress 716 W. Ave. G, Temple
Trustee, 3-year	Laura Hoffman 1408 Pa. Ave., Fort Worth
Trustees yet to serve:	
1-year	Marcella Cable
1-year	Vergie Kennedy
2-year	Osa Beck

TENNESSEE

Tennessee Association of Nurse Anesthetists' annual meeting held in Memphis, February 12, 1942, in conjunction with Mid-South Post Graduate Nurse Anesthetists' Assembly. Miss Anne Beddow, Chief Anesthetist St. Joseph Hospital, Memphis, demonstrated administration of sodium pentothal to large group of doctors and anesthetists.

Officers Elected:

President
Ruthie Hawne
Crisler Clinic, Memphis

First Vice-President
Alberta K. Sullivan
48 S. Diana St., Memphis

Second Vice-President
Lucy B. Gaffeney
St. Joseph Hospital, Memphis

Secretary-Treasurer
Theresa W. Trail
615 North Willett St., Memphis

Historian
Betty J. Gilmore
Gartley-Ramsey Hospital, Memphis

Ruthie Hawne
President

Trustees:

1-year	Ethel Sellers
2-year	Antoinette Rossi
3-year	Arline S. Johnson
3-year	Mary Ellen McCue

WASHINGTON

Mildred Peterson, President, made annual visit to Eastern Division in March and was tendered a dinner at Spokane City Club.

Officers elected for Eastern Division

President	Eileen Tramm Deaconess Hospital, Spokane
Vice-President	Katherine T. Borgardts E. 1621 Everett Ave., Spokane
Secretary-Treasurer	**Marguerite M. Olsen** Paulsen Medical & Dental Bldg., Spokane

Western Division met March 25 at Providence Hospital, Seattle.

Officers elected for Western Division

President	Sylvia M. Chapman Tacoma General Hospital, Tacoma

Vice-President	Martha B. Lee Puyallup General Hospital, Puyallup
Secretary-Treasurer	Saima M. Maki Providence Hospital, Seattle

The Washington Association has offered its services to the American Red Cross, particularly in regard to instruction to nurses' aides.

Third annual meeting was held in Seattle, April 17 and 18, 1942, in conjunction with Washington Association of Western Hospitals. Forty-nine anesthetists were registered. Invocation was offered by the Rev. Msgr. Gallagher of the Diocese of Seattle.

In her opening address Mildred Peterson, President, stressed unity and cooperation in the national emergency. Esther Rudkin, Treasurer, stated that members had been prompt in payment of dues and that fifteen new members had been added. It was voted to send the President and possibly two other delegates to annual meeting of the American Association in St. Louis. The placque presented to the organization by the American Hospital Association in recognition of its membership was on exhibition.

Officers elected:

President	Mildred Peterson 705 Broadway, Seattle
Vice-President	Mary E. Leonard Paulsen Medical & Dental Hospital, Spokane
Secretary	Rose O'Neill 1330 Boren Avenue, Seattle
Treasurer	Esther Rudkin Deaconess Hospital, Spokane

On Friday a joint panel discussion was held to discuss problems affecting hospitals and anesthetists, the anesthetists being represented by Mildred Peterson.

Victory luncheon held at Washington Athletic Club, address by Fred Jarvis, M.D., Seattle, "The Surgeon and the Nurse Anesthetist."

At afternoon session a paper was given by Joseph Lynch, M.D., Neurologist, Chief of Anesthesia Department, Sacred Heart Hospital, Spokane, on the subject "Anesthesia in Brain Surgery," and by Aura Hakala, Portland, Oregon, on "Cyclopropane Anesthesia." At 6:00 P.M. a reception was held at the home of Mrs. Peterson.

On Saturday morning clinics were held at Providence and Swedish Hospitals. The Washington State Hospital Association conducted an "Information Please" session, with the anesthetists represented by Rose O'Neill, Seattle, and a joint luncheon at the Olympic Hotel followed.

ALUMNAE ASSOCIATIONS

Charity Hospital School of Anesthesia

Alumnae of Charity Hospital School of Anesthesia met March 23, 1942, Jung Hotel, New Orleans, in conjunction with Louisiana Association of Nurse Anesthetists. Attendance and interest were good.

Officers elected:

President	Jeanne Robichaux 619 Chartres Street, New Orleans
Vice-President	Shirley E. Lewis Charity Hospital, New Orleans
Secretary	Lena Pellessier Illg 327 S. Alexander Street, New Orleans
Treasurer	Rosalie G. Sullivan 415 Codifer Avenue, New Orleans

Grace Hospital School of Anesthesiology

Second anniversary dinner meeting held at Abington Hotel, Detroit, January 15. Voted to donate five dollars toward first prize in contest for student anesthetists.

March dinner meeting held March 12 at Abington Hotel. Dr. Myra Babcock, Director of Anesthesia, Grace Hospital, Detroit, guest speaker, gave a talk on "The Newer Conceptions of the Treatment of Shock," which was followed by general discussion.

Plan taken under consideration to sponsor a series of classes in parliamentary law for members in Detroit and surrounding territory, for fall, if sufficient interest indicated by replies to questionnaire.

It was decided to invite as guests to all meetings, the anesthetists taking the refresher course at Grace Hospital.

Officers elected at anniversary meeting:

President	Ethel M. Moir Henry Ford Hospital, Detroit
President-Elect	Anna Mae Palmer Highland Park General Hospital, Highland Park, Mich.
First Vice-President	Alice V. Zolman Pontiac General Hospital, Pontiac, Mich.
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SAINT LOUIS, OUR NEXT CONVENTION CITY

An enthusiastic literary visitor recently wrote: *"Through her clear spring skies now sweep giant fighting ships, designed in her own great plants to speed the defense of a nation. Her rushing 'Father of Waters', the Mississippi, swells with ships of grain and ore and steel. Her rail beds roar day and night with the thunder of her nineteen railroads that make her the crossroads of a busy nation. The mighty hearts of her men and women pound out their daily contribution to the greatest era in her history — the New Saint Louis."*

This ringing tribute to the city of magnificent buildings, parks and boulevards, emblazons the progress of this French-founded metropolis, from its quaint fur-trading-post origin to its present stature as the largest gateway city in the United States.

And with that commercial and industrial development has gone hand in hand a parallel civic growth, as evidenced by her great auditoriums for the housing of her internationally known Philharmonic Orchestra, her Art Museum and national conventions of professional and scientific associations such as those in which we will participate there next October.

Great medical centers have grown up within her boundaries, such as those surrounding Washington University, St. Louis University and the Cancer and Radiological Research Institutes.

Spacious wooded parks stud her metropolitan area, culminating in the famed Shaw Botanical Gardens wherein is contained the largest collection of plant life in the Western Hemisphere.

St. Louis hotels are spacious, modern and hospitable. Distances between points of interest are convenient, transportation is rapid and economical, and schedules are good.

Come to St. Louis and the convention next October, for intellectual profit, for the stimulating interchange of social and professional contacts and for relaxation and enjoyment.

CURRENT STATUS OF THE NURSE ANESTHETIST ENTERING MILITARY SERVICE

With a view to clarifying further the status of the nurse anesthetist in the Armed Forces, your officers have again contacted the heads of indicated Army and Navy departments. The following is presented to acquaint you with the situation at this writing.

Under date of April 2, Colonel Julia O. Flikke, Superintendent of the Army Nurse Corps wrote as follows:—

"Acknowledgment is hereby made of your letter of March 16, suggesting an appropriate rank for nurse anesthetists. Under existing regulations, all nurses must be appointed in the Corps in the grade of nurse with the relative rank of Second Lieutenant and be available for any assignment in which their services may be required.

"During peace time this was a logical provision, since except in the Army General Hospitals the administration of anesthesia was not a full time job, nor has it been possible for us to secure an increase in the Nurse Corps quota to provide nurses for that specific assignment.

"However, under existing circumstances it seems quite necessary and highly desirable to secure as great a number of qualified nurse anesthetists as possible for the Army and a recommendation for special emergency regulations to provide for the appointment of qualified nurse anesthetists in an appropriate grade has been forwarded to the Adjutant General. Upon receipt in this office of information concerning the action taken by the War Department on our recommendation, you will be notified cancerning the details."

Under date of March 25, Miss Sue M. Dauser, Superintendent of the Navy Nurse Corps wrote:—

"When a nurse anesthetist requests appointment in the Navy Nurse Corps we endeavor to determine whether or not she is willing to make her services a little more variable than is specifically stated on her application, since in most Naval Hospitals the nurse anesthetist is not continually engaged with anesthesia. Paramount in every Naval Hospital program is supervision and instruction of hospital corpsmen and the nurse anesthetist has an additional detail in dressing room and surgical supervision which entails her share in this instruction. We have found the nurse anesthetist is willing to accept Navy duty on these conditions, since a similar situation exists in many civilian hospitals.

"We realize and appreciate the value of nurses with specific educational advantages and we feel that she above all can understand the service situation in which she finds herself and can make adjustments that are satisfactory to all concerned.

"As yet we have not found it necessary to detail anesthetists to bedside nursing care and it is doubted if such duty assignment will ever become necessary."

When further changes in the situation develop, you will be advised of them through the columns of the Bulletin.

OFFICERS

AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

President	Helen Lamb Barnes Hospital, St. Louis, Mo.
Vice-President	Rosalie C. McDonald Emory University Hospital Emory University, Ga.
Treasurer	Gertrude L. Fife University Hospitals, Cleveland, Ohio
Trustees	Helen Lamb Rosalie C. McDonald Gertrude L. Fife Agatha C. Hodgins Miriam G. Shupp Hazel Blanchard Lucy E. Richards Rose G. Donavan

CORRECTION

The notice published in the February issue of the Bulletin, page 33, concerning membership dues was slightly misleading to the membership at large. This notice was intended for the state treasurers and for the members in the unorganized states.

All members in *organized states* should continue to send their dues to their respective state treasurer, who deducts the state's proportionate share, then sends the balance to Headquarters.

Members in the unorganized states will continue to send their dues direct to Headquarters.

In Memorium

Miss Grethe Westly of Lutheran Deaconess Hospital, Minneapolis, died January 29, 1942, after an illness of three months. Miss Westly served in France during the first World War. She was graduated from Ravenswood Hospital School of Anesthesia, and since 1926 had been employed at Deaconess Hospital. She had been an active member of the American Association of Nurse Anesthetists since its organization and was a charter member of the Minnesota Association.

The Surgeon's Ideal

Discussing relaxation in surgery, N. A. Gillespie[1] states: "Nevertheless ether, administered by the 'open' or 'semi-open' technique on a gauze mask and with an excess of oxygen, does very nearly approach the surgeon's ideal of operating conditions. The safety of this agent is proverbial, and it is capable of producing these conditions (flaccidity of musculature and peritoneum) in every patient, given sufficient skill in its administration."

From this observation—and from those of many other leaders in the field of anesthesia—it may be concluded that ether is highly satisfactory from the standpoints of relaxation and safety. Ether is not only safe—it is controllable and generally free from untoward after-effects. It is the most adaptable and the most widely used anesthetic agent—the one that can always be relied upon.

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Over 85% of American hospitals use Squibb Ether in millions of cases every year. Such widespread use is evidence of the confidence which surgeons and anesthetists have in the ability of Squibb Ether to produce safe, satisfactory anesthesia.

[1]Gillespie, N. A.: *Anesthesiology* 1:292 (Nov.) 1940.

For literature address the Anesthetic Department,
E. R. Squibb & Sons, 745 Fifth Ave., New York

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